General Methods

NMR spectra were recorded on Bruker Avance 300 (300 MHz. Chemical shifts (ppm) are given relative to solvent: references for $CDCl_3$ were 7.26 ppm (^{1}H-NMR) and 77.0 ppm (^{13}C-NMR). ^{13}CNMR spectra were acquired on a broad band decoupled mode. Multiplets were assigned as s (singlet), d (doublet), t (triplet), dd (doublet of doublet), m (multiplet) and br. s (broad singlet). All measurements were carried out at room temperature unless otherwise stated. Gas chromatography analysis was performed on an Agilent HP-5890 instrument with a FID detector and HP-5 capillary column (polydimethylsiloxane with 5% phenyl groups, 30 m, 0.32 mm i.d., 0.25 μm film thickness) using argon as carrier gas. The products were isolated from the reaction mixture by column chromatography on silica gel 60, 0.063-0.2 mm, 70-230 mesh (Merck).

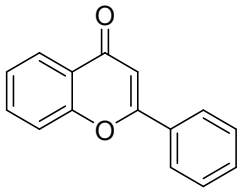
All reactions were carried out under air atmosphere. All the reagents were purchased from Sigma-Aldrich or Alfa-Aesar chemical company.

Typical reaction procedure for the carbonylative synthesis of flavone: 10 % Pd/C (1 mol %; 2.5 mg), 2-iodophenol (0.25 mmol), ethynylbenzene (0.3 mmol), diethylamine (0.5 mmol) and toluene (1 mL)were transferred into a vial (5 mL reaction volume) equipped with a septum, a small cannula and a stirring bar. Then, the vial was placed in an alloy plate, which was transferred into a 300 mL autoclave of the 4560 series from Parr Instruments® under air atmosphere. After flushing the autoclave three times with CO, a pressure of 20 bar was adjusted and the reaction was performed for 20 hours at 110^{o}C. After the reaction, the autoclave was cooled down to room temperature and the pressure was released carefully. The crude product was purified by column chromatography using pentante/AcOEt (5:1) as eluent.

Procedure for Catalyst Recycling

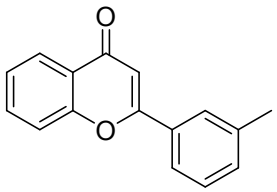
The catalyst obtained after filtration was thoroughly washed with distilled water (3-5 mL) and then with methanol, ethyl acetate and acetone (3-5 mL) to remove any traces of organic material if present. The resulting catalyst was dried and was then used for the next cycle.

2-Phenyl-4*H*-chromen-4-one



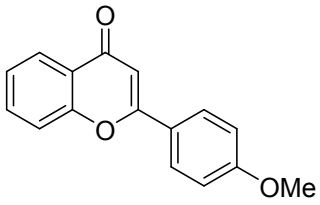
^{1}H NMR (300 MHz, Chloroform-*d*) δ 8.24 (dd, *J* = 8.0, 1.6 Hz, 1H), 7.98-7.88 (m, 2H), 7.70 (ddd, *J* = 8.6, 7.1, 1.7 Hz, 1H), 7.62-7.49 (m, 4H), 7.48-7.36 (m, 1H), 6.85 (s, 1H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.47, 163.49, 156.28, 133.83, 131.76, 131.65, 129.06, 126.32, 125.71, 125.27, 123.91, 118.10, 107.56.

2-(*m*-Tolyl)-4*H*-chromen-4-one



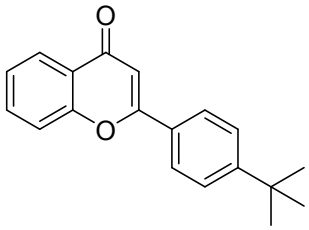
^{1}H NMR (300 MHz, Chloroform-*d*) δ 8.21 (ddd, *J* = 8.0, 1.7, 0.5 Hz, 1H), 7.74-7.63 (m, 3H), 7.56 (ddd, *J* = 8.4, 1.1, 0.5 Hz, 1H), 7.44-7.30 (m, 3H), 2.44 (s, 3H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.49, 163.66, 156.28, 138.86, 133.77, 132.46, 131.70, 128.96, 126.86, 125.68, 125.21, 123.95, 123.53, 118.13, 107.51, 21.55.

2-(4-Methoxyphenyl)-4*H*-chromen-4-one



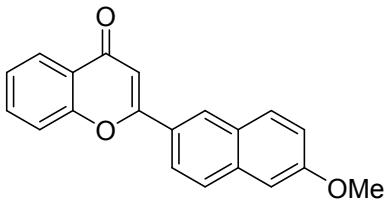
^{1}H NMR (300 MHz, Chloroform-*d*) δ 8.13 (dt, *J* = 7.9, 1.3 Hz, 1H), 7.85 – 7.73 (m, 2H), 7.59 (ddt, *J* = 8.6, 7.1, 1.4 Hz, 1H), 7.45 (dt, *J* = 8.5, 1.2 Hz, 1H), 7.32 (ddt, *J* = 8.1, 7.1, 1.2 Hz, 1H), 6.98-86 (m, 2H), 6.66 (s, 1H), 3.79 (s, 3H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.37, 163.44, 162.42, 156.17, 133.61, 128.02, 125.64, 125.11, 123.96, 123.88, 117.99, 114.47, 106.12, 55.54.

2-(4-(*tert*-Butyl)phenyl)-4*H*-chromen-4-one



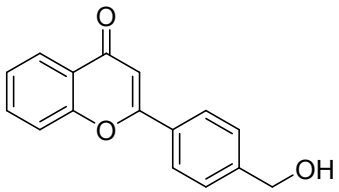
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.13 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.76 (d, *J* = 8.5 Hz, 2H), 7.58 (ddd, *J* = 8.7, 7.1, 1.7 Hz, 1H), 7.50 – 7.36 (m, 3H), 7.34 – 7.25 (m, 1H), 6.71 (s, 1H), 1.27 (s, 9H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 178.44, 163.59, 156.26, 155.34, 133.68, 128.91, 126.15, 126.06, 125.67, 125.14, 124.01, 118.09, 107.07, 35.05, 31.15.

2-(6-Methoxynaphthalen-2-yl)-4*H*-chromen-4-one



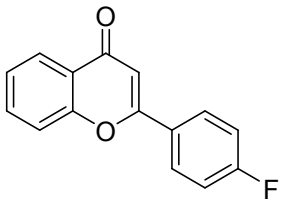
^{1}H NMR (300 MHz, Chloroform-*d*) δ 8.25 (d, *J* = 1.4 Hz, 1H), 8.13 (dd, *J* = 7.9, 1.6 Hz, 1H), 7.80 -7.44 (m, 5H), 7.31 (ddd, *J* = 8.1, 7.1, 1.1 Hz, 1H), 7.16-7.00 (m, 2H), 6.79 (s, 1H), 3.84 (s, 3H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.43, 163.55, 159.38, 156.27, 136.26, 133.72, 130.62, 128.31, 127.63, 126.69, 126.50, 125.67, 125.16, 123.98, 123.09, 120.02, 118.08, 107.10, 105.77, 55.46.

2-(4-(Hydroxymethyl)phenyl)-4*H*-chromen-4-one



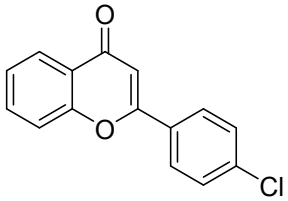
^{1}H NMR (300 MHz, MeOD-d_1) δ 6.82 (d, J = 8.0 Hz, 1H), 6.70 (d, J = 8.1 Hz, 2H), 6.56-6.46 (m, 1H), 6.44-6.37 (m, 1H), 6.28-6.07 (m, 3H), 3.39 (s, 2H).
^{13}C NMR (75 MHz, MeOD) δ 179.07, 164.26, 156.20, 145.97, 134.22, 129.82, 126.83, 126.10, 125.24, 124.59, 123.01, 118.01, 105.86, 62.97.

2-(4-Fluorophenyl)-4*H*-chromen-4-one



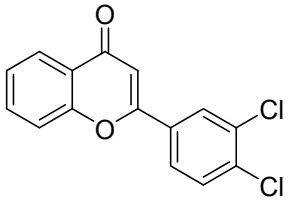
^{1}H NMR (300 MHz, Chloroform-d) δ 8.13 (d, J = 7.9 Hz, 1H), 7.90-7.78 (m, 2H), 7.68-7.56 (m, 1H), 7.47 (d, J = 8.5 Hz, 1H), 7.34 (t, J = 7.5 Hz, 1H), 7.23-7.06 (m, 2H), 6.69 (s, 1H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.70, 164.77(d, J = 253.1 Hz),162.43, 156.17, 133.90, 128.53 (d, J = 8,9 Hz), 127.95 (d, J = 3,3 Hz), 125.73, 125.36, 123.87, 118.04, 116.3(d, J = 23,0 Hz), 107.34.

2-(4-Chlorophenyl)-4*H*-chromen-4-one



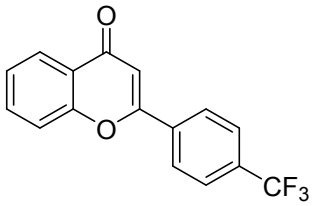
^{1}H NMR (300 MHz, Chloroform-d) δ 8.22 (dd, J = 7.9, 1.6 Hz, 1H), 7.86 (d, J = 7.3 Hz, 2H), 7.76-7.64 (m, 1H), 7.41 (dd, J = 8.0, 1.0 Hz, 4H), 6.80 (s, 1H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.30, 162.29, 156.18, 137.95, 133.99, 130.22, 129.42, 127.58, 125.77, 125.44, 123.88, 118.08, 107.67.

2-(3,4-Dichlorophenyl)-4*H*-chromen-4-one



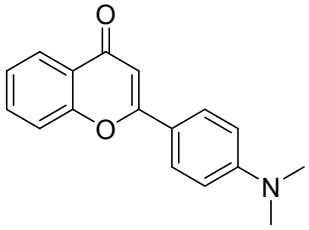
^{1}H NMR (300 MHz, Chloroform-d) δ 8.20-8.10 (m, 1H), 7.96 (d, J = 2.1 Hz, 1H), 7.72-7.60 (m, 2H), 7.59-7.46 (m, 2H), 7.37 (ddd, J = 8.1, 7.1, 1.1 Hz, 1H), 6.72 (s, 1H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.11, 160.92, 156.11, 136.01, 134.18, 133.73, 131.68, 131.16, 128.10, 125.81, 125.62, 125.31, 123.85, 118.11, 108.18.

2-(4-(Trifluoromethyl)phenyl)-4*H*-chromen-4-one



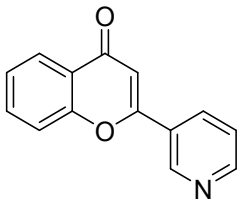
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.21 (dd, *J* = 8.0, 1.7 Hz, 1H), 8.02 (d, *J* = 8.2 Hz, 2H), 7.80 – 7.66 (m, 3H), 7.60 – 7.53 (m, 1H), 7.47 – 7.38 (m, 1H), 6.84 (s, 1H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 178.15, 161.59, 156.20, 135.19, 134.13, 133.14(q, *J* = 32.6 Hz), 126.65, 126.05(q, *J* = 3.8 Hz), 125.79, 125.56, 123.93,123.63(q, *J* = 271.6 Hz), 118.14, 108.73.

2-(4-(Dimethylamino)phenyl)-4*H*-chromen-4-one



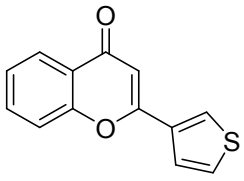
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.13 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.76-7.67 (m, 2H), 7.56 (ddd, *J* = 8.7, 7.1, 1.7 Hz, 1H), 7.47-7.39 (m, 1H), 7.32-7.25 (m, 1H), 6.67- 6.62 (m, 2H), 6.60 (s, 1H), 2.97 (s, 6H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 178.26, 164.31, 156.16, 152.46, 133.17, 127.70, 125.54, 124.76, 124.07, 118.20, 117.85, 111.62, 104.37, 40.08.

2-(Pyridin-3-yl)-4*H*-chromen-4-one



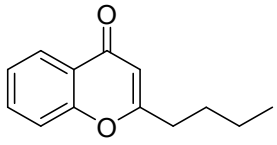
^{1}H NMR (300 MHz, Chloroform-*d*) δ 9.17 (d, *J* = 2.3 Hz, 1H), 8.76 (dd, *J* = 4.8, 1.6 Hz, 1H), 8.22 (dd, *J* = 8.2, 1.6 Hz, 2H), 7.77-7.66 (m, 1H), 7.62-7.53 (m, 1H), 7.53-7.38 (m, 2H), 6.84 (s, 1H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.02, 161.05, 156.23, 152.23, 147.56, 134.16, 133.59, 127.89, 125.83, 125.61, 123.95, 123.76, 123.38, 118.14, 108.45.

2-(Thiophen-3-yl)-4*H*-chromen-4-one



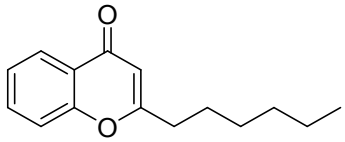
^{1}H NMR (300 MHz, Chloroform-*d*) δ 8.22 (dd, *J* = 8.0, 1.8 Hz, 1H), 8.02 (d, *J* = 2.1 Hz, 1H), 7.79-7.66 (m, 2H), 7.66-7.53 (m, 2H), 7.44 (ddd, *J* = 8.1, 7.1, 1.1 Hz, 1H), 6.79 (s, 1H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.11, 160.92, 156.11, 136.01, 134.18, 131.16, 128.10, 125.81, 125.62, 125.31, 123.85, 118.11, 108.18.

2-Butyl-4*H*-chromen-4-one



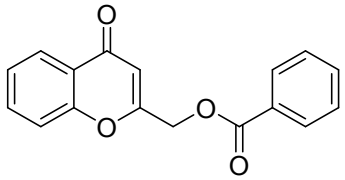
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.18 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.63 (dd, *J* = 7.1, 1.6 Hz, 1H), 7.46-7.33 (m, 2H), 6.19 (s, 1H), 2.67- 2.58 (m, 2H), 1.77-1.66 (m, 2H), 1.42 (dd, *J* = 14.8, 7.4 Hz, 2H), 0.96 (t, *J* = 7.3 Hz, 3H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 178.34, 169.84, 156.57, 133.42, 125.69, 125.07, 124.90, 117.88, 109.86, 34.08, 28.89, 22.15, 13.76.

2-Hexyl-4*H*-chromen-4-one



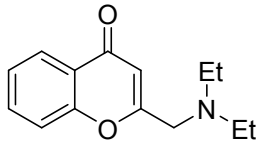
^{1}H NMR (300 MHz, Chloroform-*d*) δ 8.11 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.57 (ddd, *J* = 8.6, 7.1, 1.7 Hz, 1H), 7.42-7.25 (m, 2H), 6.12 (s, 1H), 2.55 (t, *J* = 7.6 Hz, 2H), 1.67 (p, *J* = 7.3 Hz, 2H), 1.42-1.15 (m, 6H), 0.91-0.76 (m, 3H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.44, 169.92, 156.53, 133.45, 125.67, 124.91, 123.71, 117.87, 109.80, 34.37, 31.48, 28.69, 26.79, 22.53, 14.07.

(4-Oxo-4*H*-chromen-2-yl)methyl benzoate



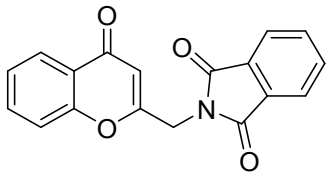
^{1}H NMR (300 MHz, Chloroform-*d*) δ 8.15 (ddd, *J* = 25.6, 8.3, 1.6 Hz, 3H), 7.74-7.55 (m, 2H), 7.54-7.35 (m, 4H), 6.49 (s, 1H), 5.27 (s, 2H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 177.94, 165.54, 162.79, 156.24, 134.01, 133.78, 129.93, 128.88, 128.66, 125.84, 125.46, 123.98, 118.06, 109.89, 61.97.

2-((Diethylamino)methyl)-4*H*-chromen-4-one

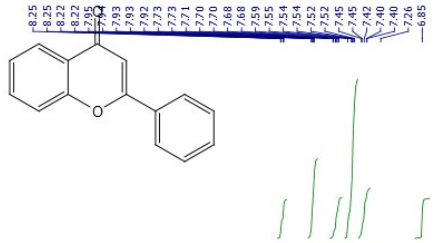


^{1}H NMR (300 MHz, Chloroform-*d*) δ 8.19 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.71-7.58 (m, 1H), 7.50-7.32 (m, 2H), 6.47 (s, 1H), 3.57 (s, 2H), 2.66 (q, *J* = 7.1 Hz, 4H), 1.09 (t, *J* = 7.1 Hz, 6H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 178.43, 169.97, 156.47, 133.51, 125.74, 125.03, 124.05, 118.07, 110.63, 55.04, 47.71, 12.07.

2-((4-Oxo-4*H*-chromen-2-yl)methyl)isoindoline-1,3-dione



^{1}H NMR (300 MHz, Chloroform-*d*) δ 8.12 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.88 (ddd, *J* = 12.9, 5.5, 3.0 Hz, 2H), 7.75 (ddd, *J* = 12.4, 5.5, 3.1 Hz, 2H), 7.63 (ddd, *J* = 8.7, 7.1, 1.7 Hz, 1H), 7.50-7.28 (m, 2H), 6.22 (s, 1H), 4.81 (s, 2H).
^{13}C NMR (75 MHz, $CDCl_3$) δ 177.83, 167.23, 162.21, 156.24, 134.61, 134.37, 133.91, 131.75, 125.77, 125.45, 123.87, 118.07, 109.58, 39.02.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8.25
8.22
8.22
7.95
7.93
7.93
7.92
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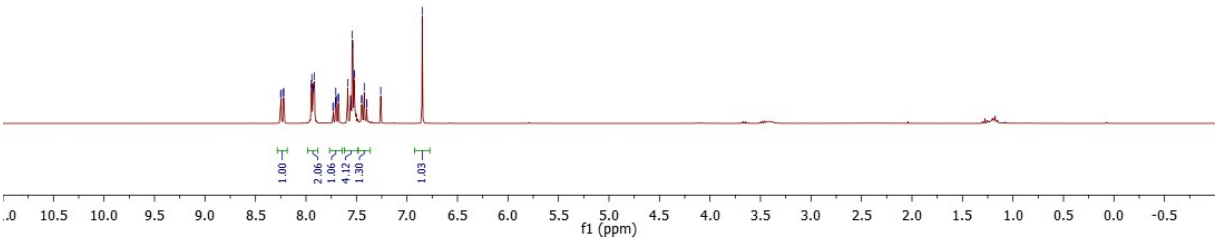
7.26
6.85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1.06
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1.03
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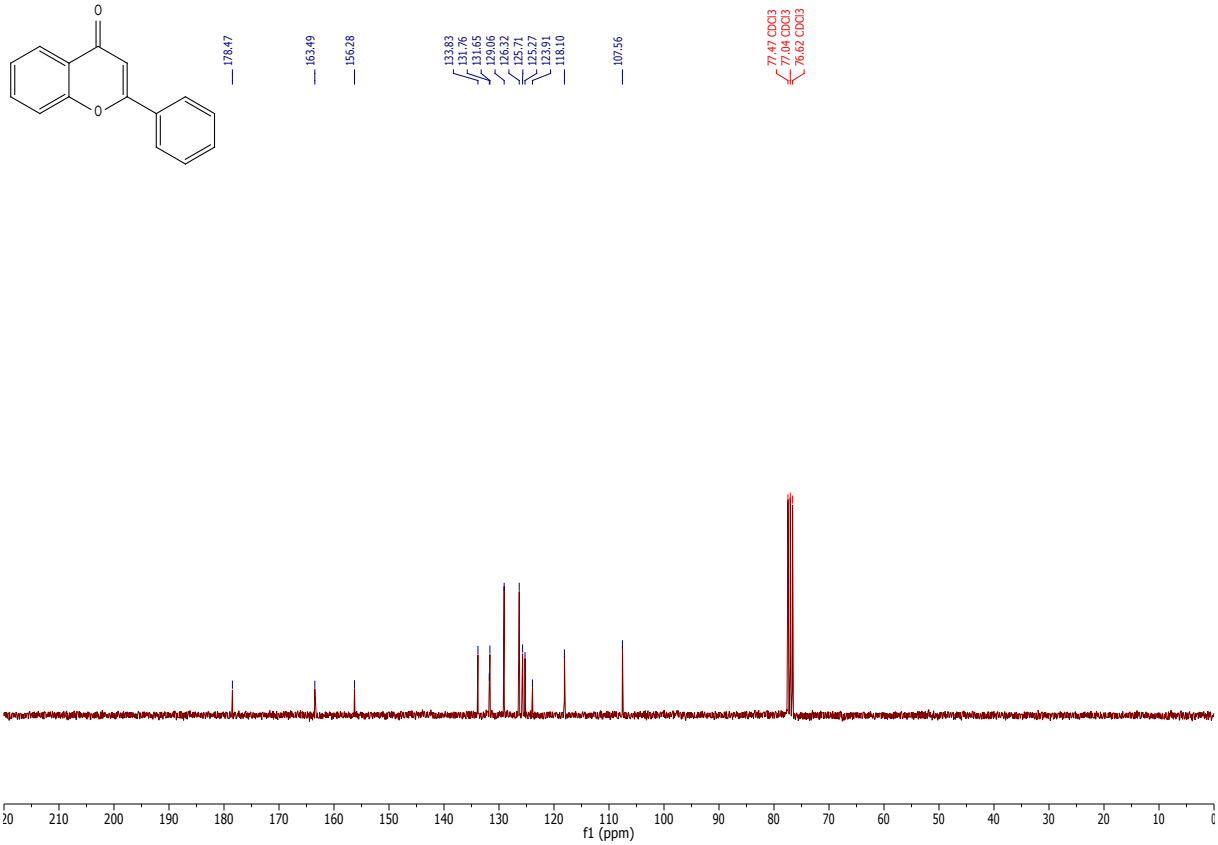
178.47
163.49
156.28
133.83
131.76
131.65
129.06
126.32
125.71
125.27
123.91
118.10
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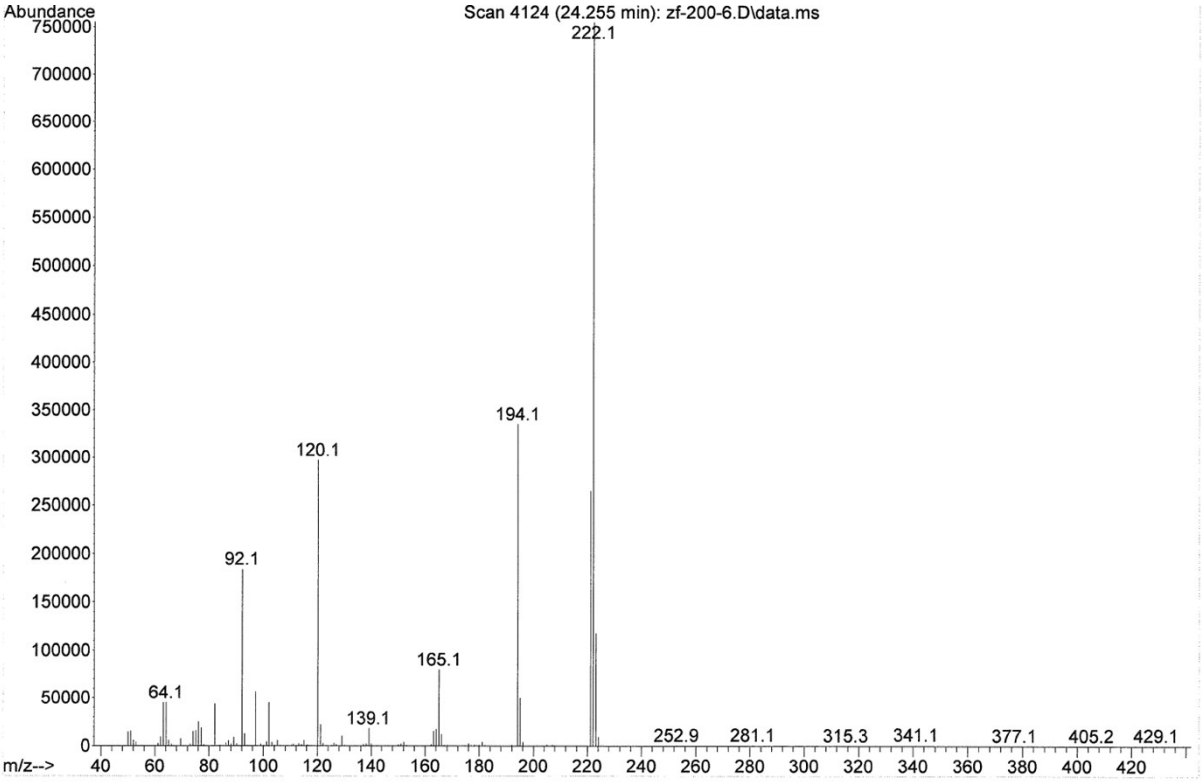
77.47 CDCl3
77.04 CDCl3
76.62 CDCl3
f1 (ppm)


Abundance
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341.1
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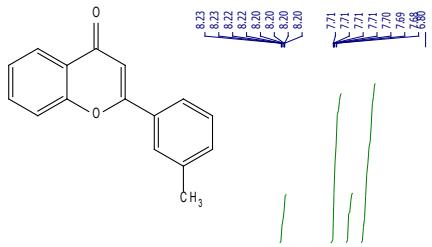
429.1
m/z-->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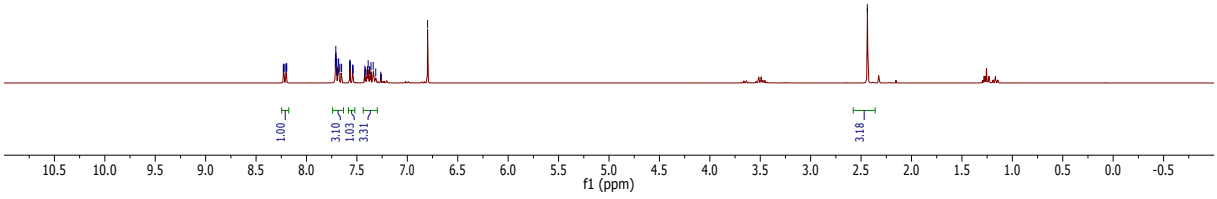
O
CH3


2.44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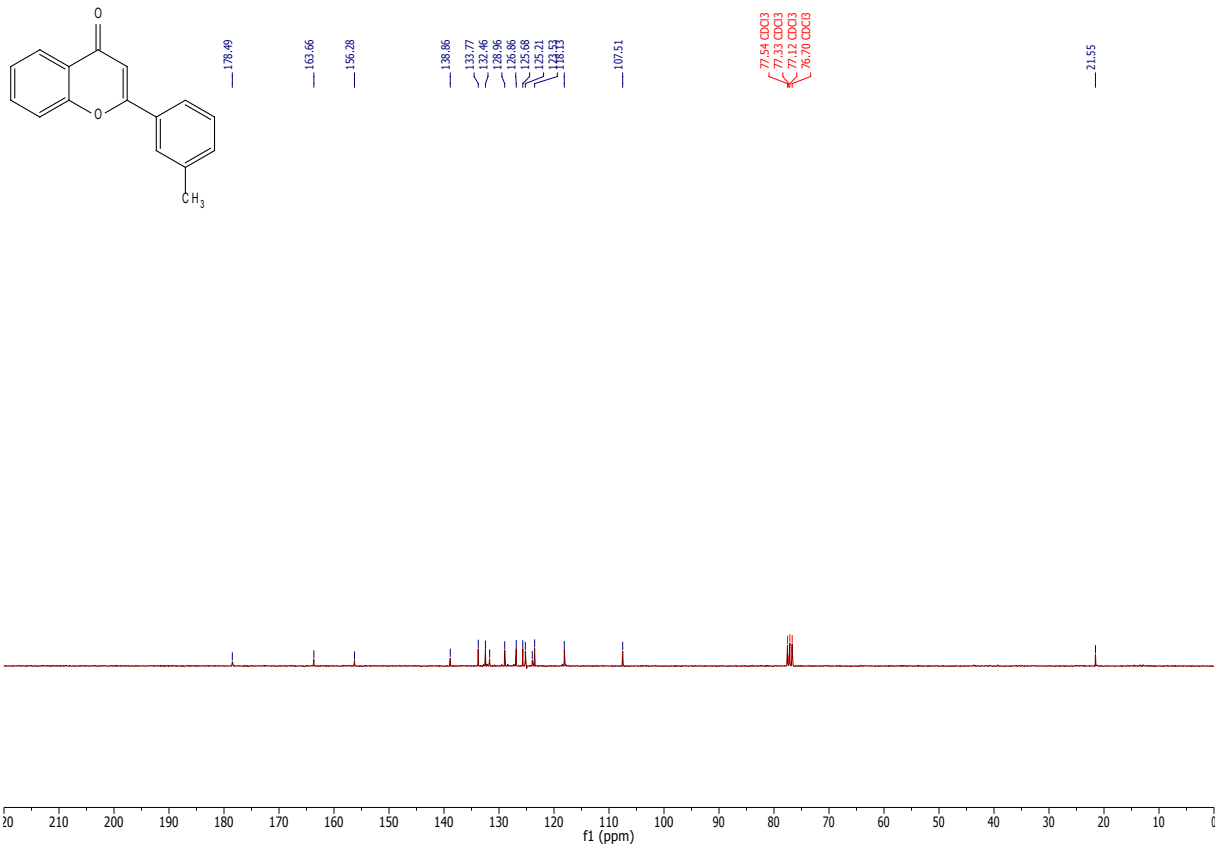
3.10
1.03
3.31
3.18
f1 (ppm)


O
O
CH3
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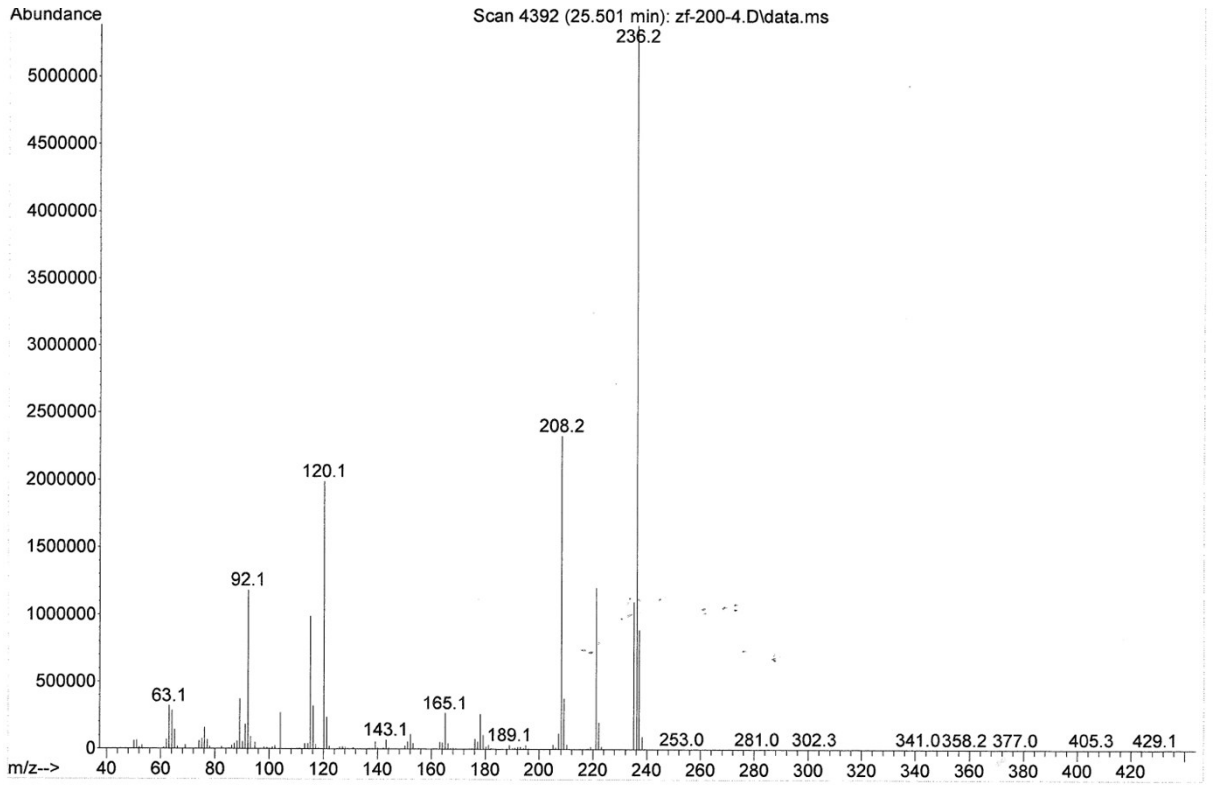
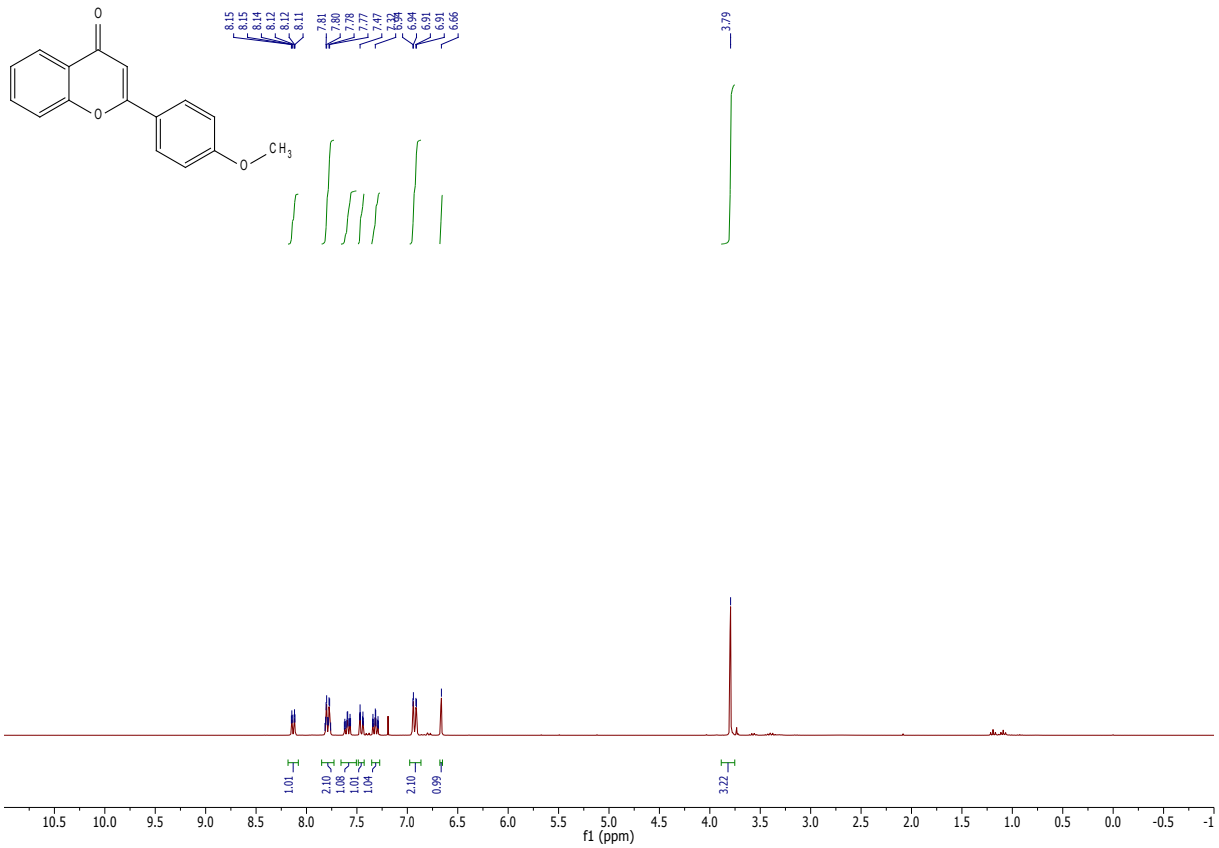
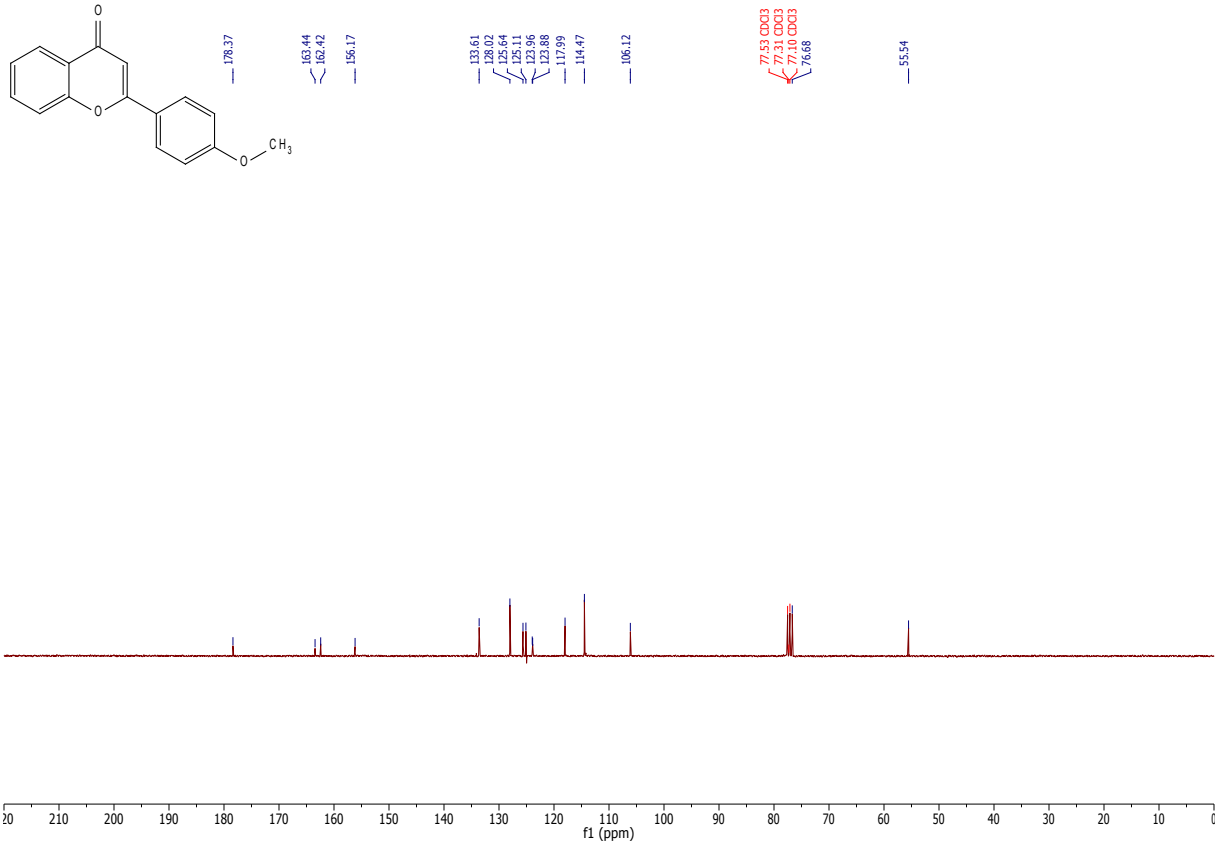
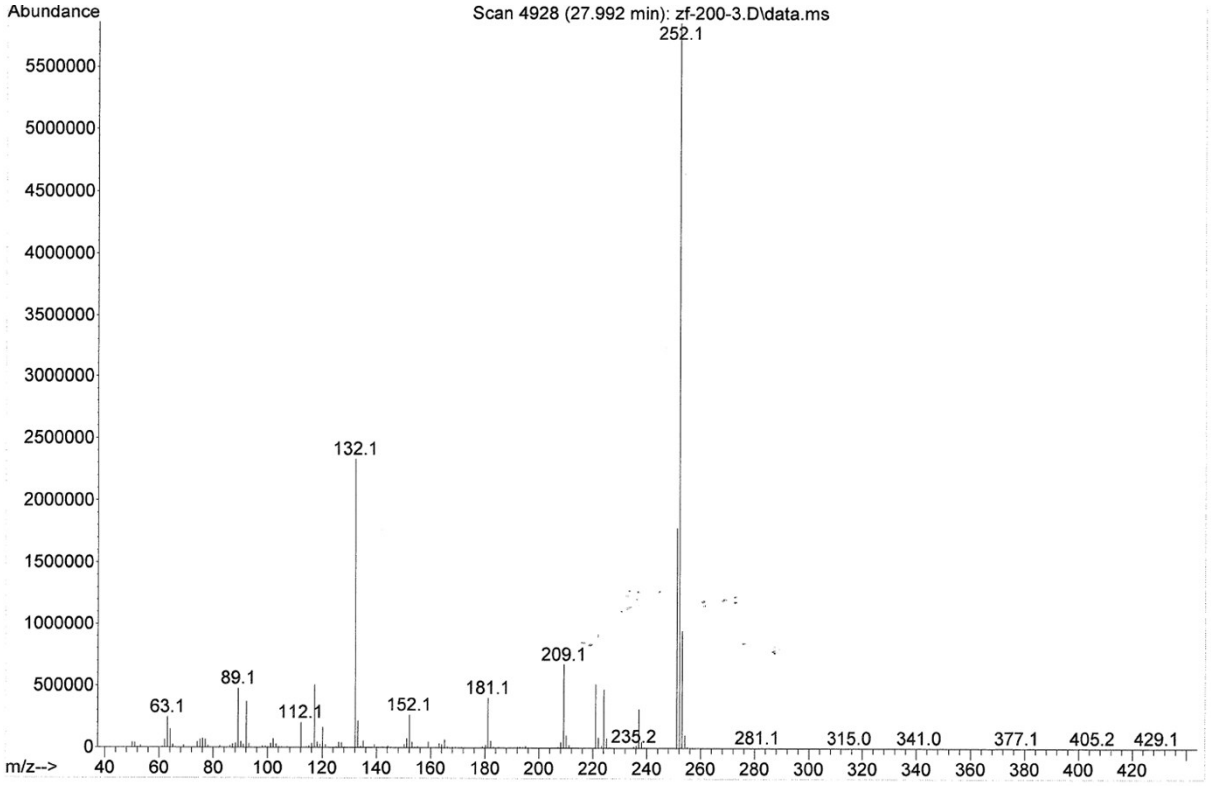
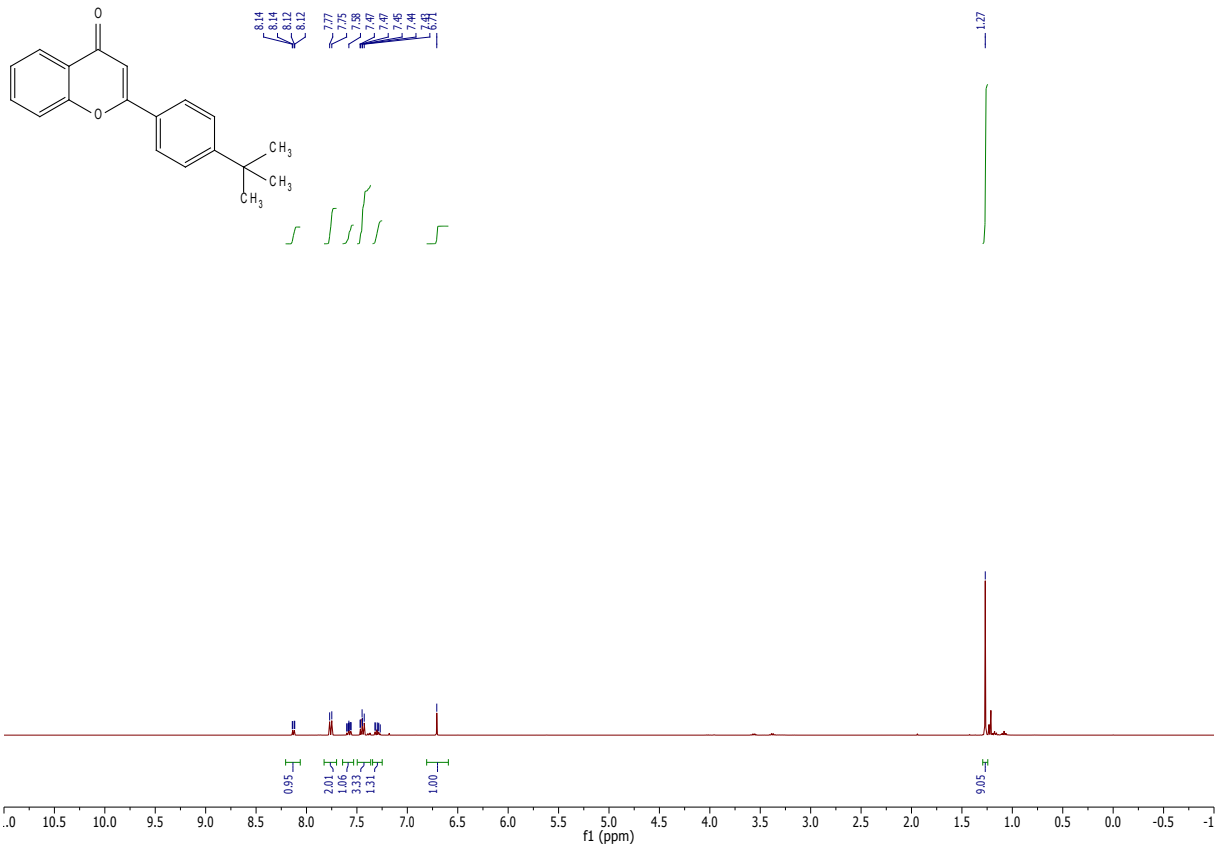
163.66
156.28
138.86
133.77
132.46
128.96
126.86
125.68
125.21
123.53
118.13
107.51
77.54 CDCl3
77.33 CDCl3
77.12 CDCl3
76.70 CDCl3
21.55
f1 (ppm)

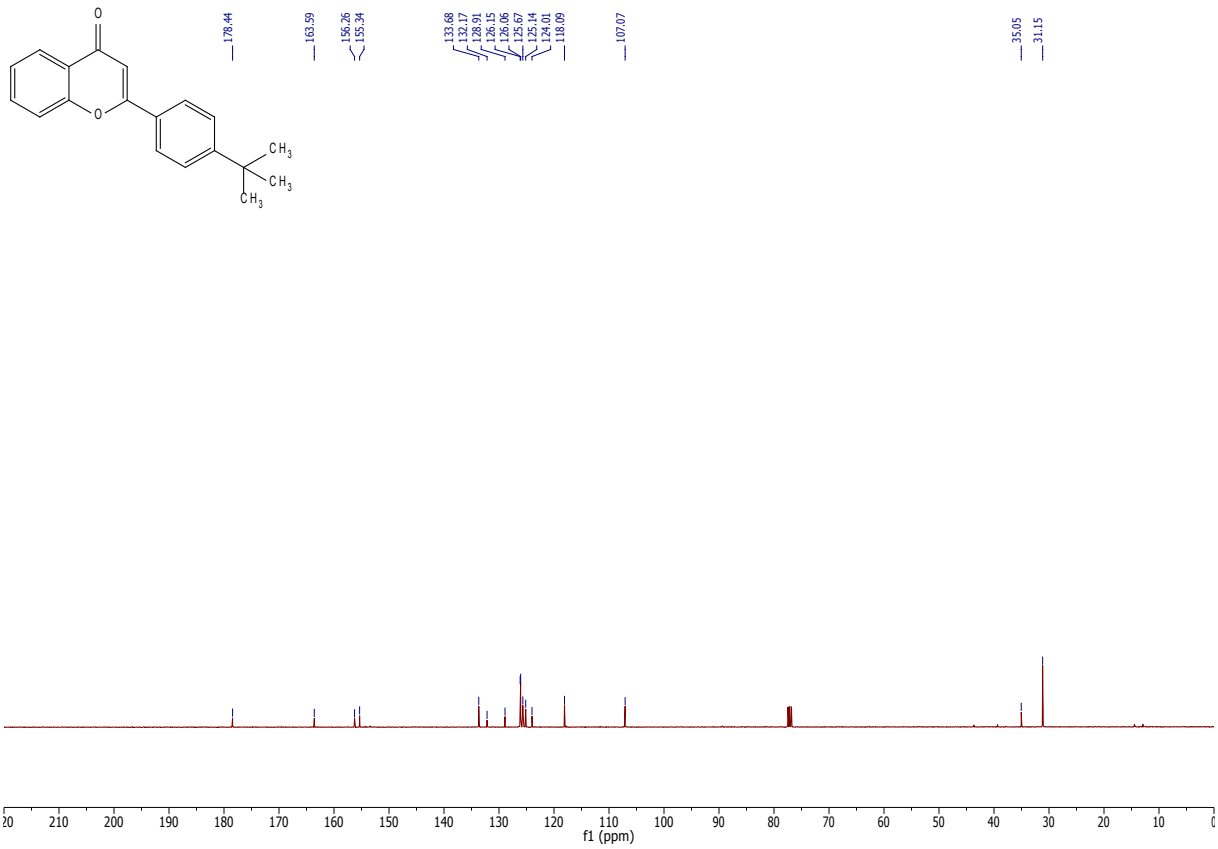

Abundance
Scan 4392 (25.501 min): zf-200-4.D\data.ms
236.2
208.2
120.1
92.1
63.1
165.1
143.1
189.1
253.0
281.0
302.3
341.0
358.2
377.0
405.3
429.1
m/z-->

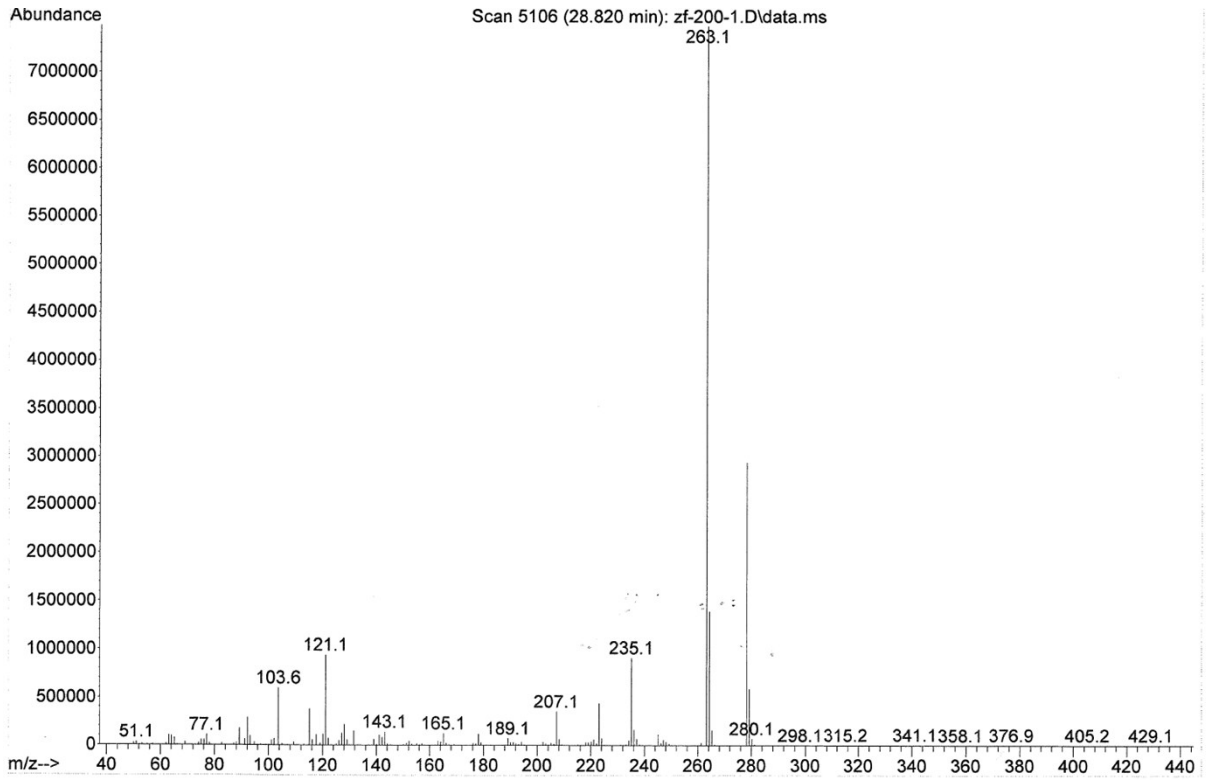

O
O
O
CH3
8.15
8.15
8.14
8.12
8.12
8.11
7.81
7.80
7.78
7.77
7.47
7.45
6.94
6.91
6.91
6.66
3.79
1.01
2.10
1.08
1.01
1.04
2.10
0.99
3.22
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1
f1 (ppm)

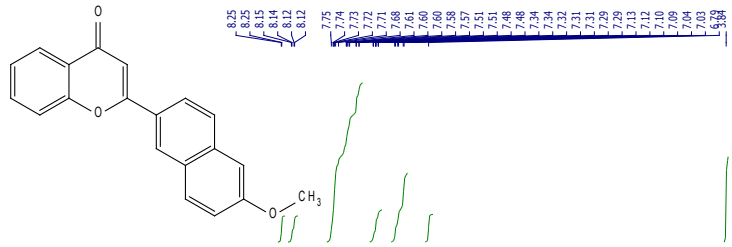

O
O
O
CH3
178.37
163.44
162.42
156.17
133.61
128.02
125.64
125.11
123.96
123.88
117.99
114.47
106.12
77.53 CDCl3
77.31 CDCl3
77.10 CDCl3
76.68
55.54
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

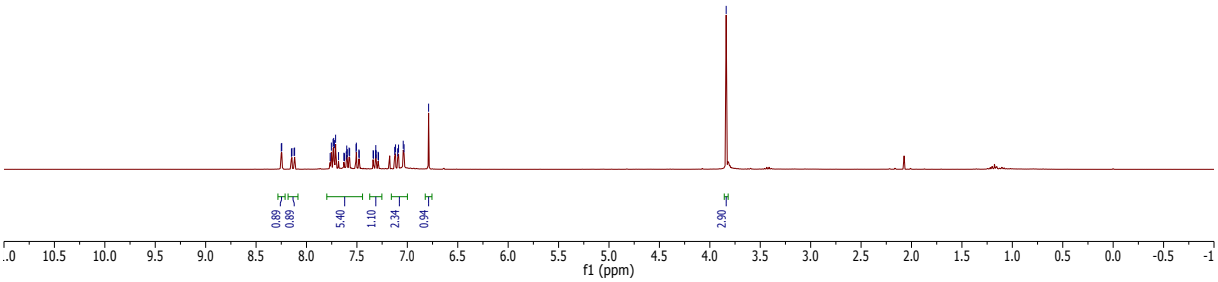

Abundance
Scan 4928 (27.992 min): zf-200-3.D\data.ms
252.1
132.1
209.1
89.1
181.1
63.1
112.1
152.1
235.2
281.1
315.0
341.0
377.1
405.2
429.1
m/z-->


O
O
CH3
CH3
CH3
8.14
8.14
8.12
8.12
7.77
7.75
7.58
7.47
7.47
7.45
7.44
7.43
6.71
1.27
0.95
2.01
1.06
3.33
1.31
1.00
9.05
f1 (ppm)

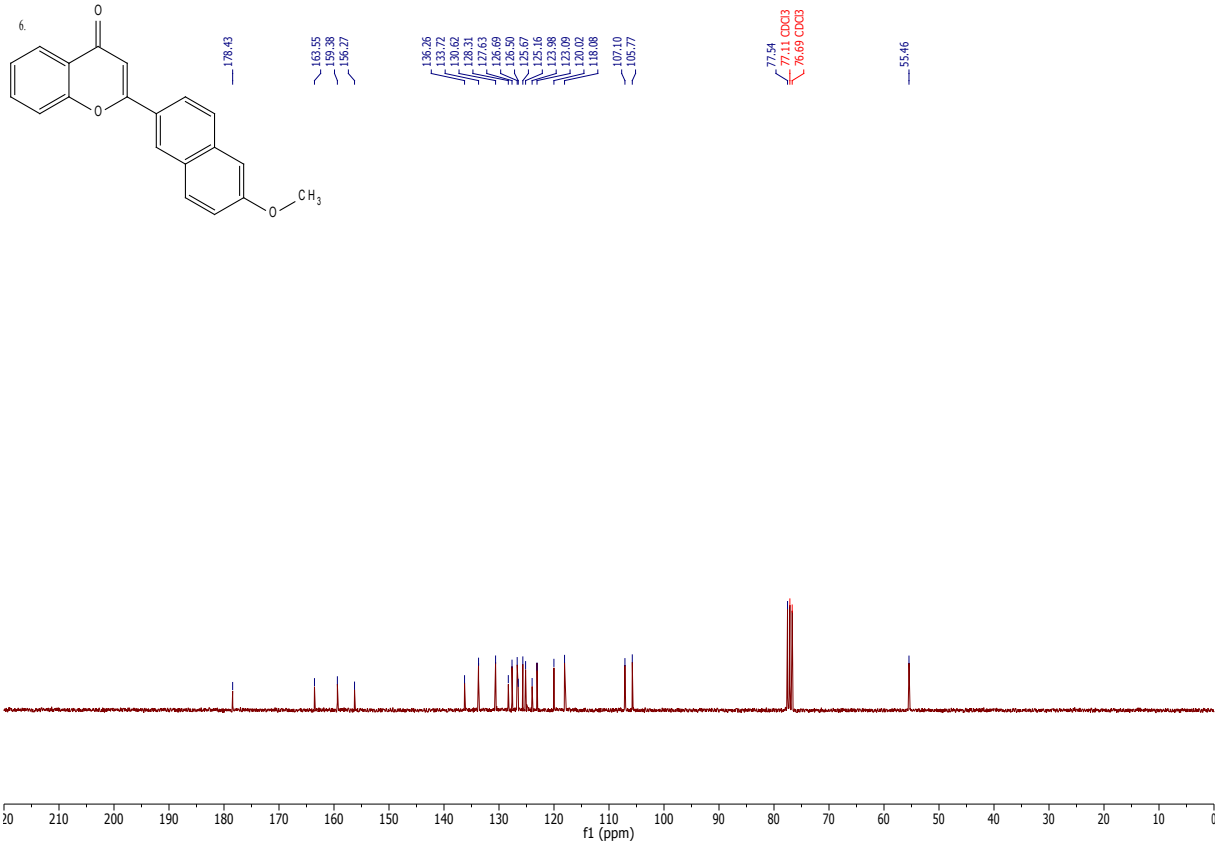

O
O
CH3
CH3
CH3
178.44
163.59
156.26
155.34
133.68
132.17
128.91
126.15
126.06
125.67
125.14
124.01
118.09
107.07
35.05
31.15
f1 (ppm)

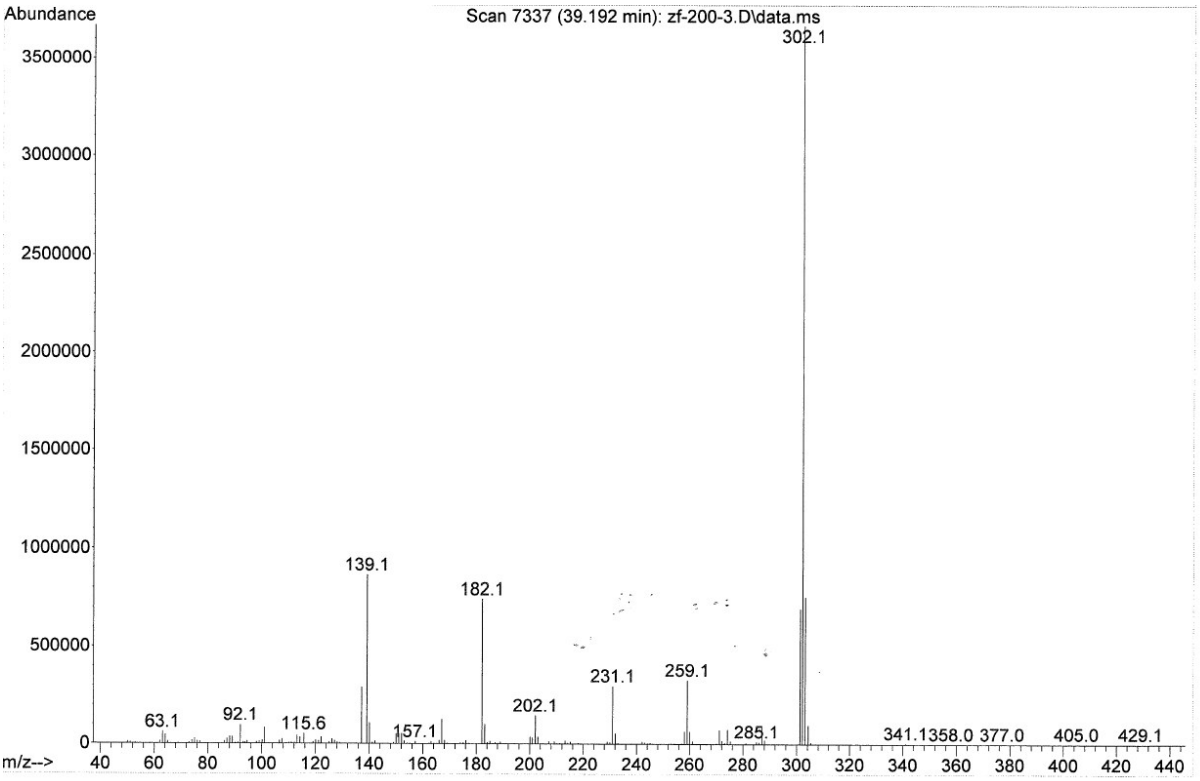

Abundance
Scan 5106 (28.820 min): zf-200-1.D\data.ms
263.1
121.1
235.1
103.6
207.1
51.1
77.1
143.1
165.1
189.1
280.1
298.1
315.2
341.1
358.1
376.9
405.2
429.1
m/z-->

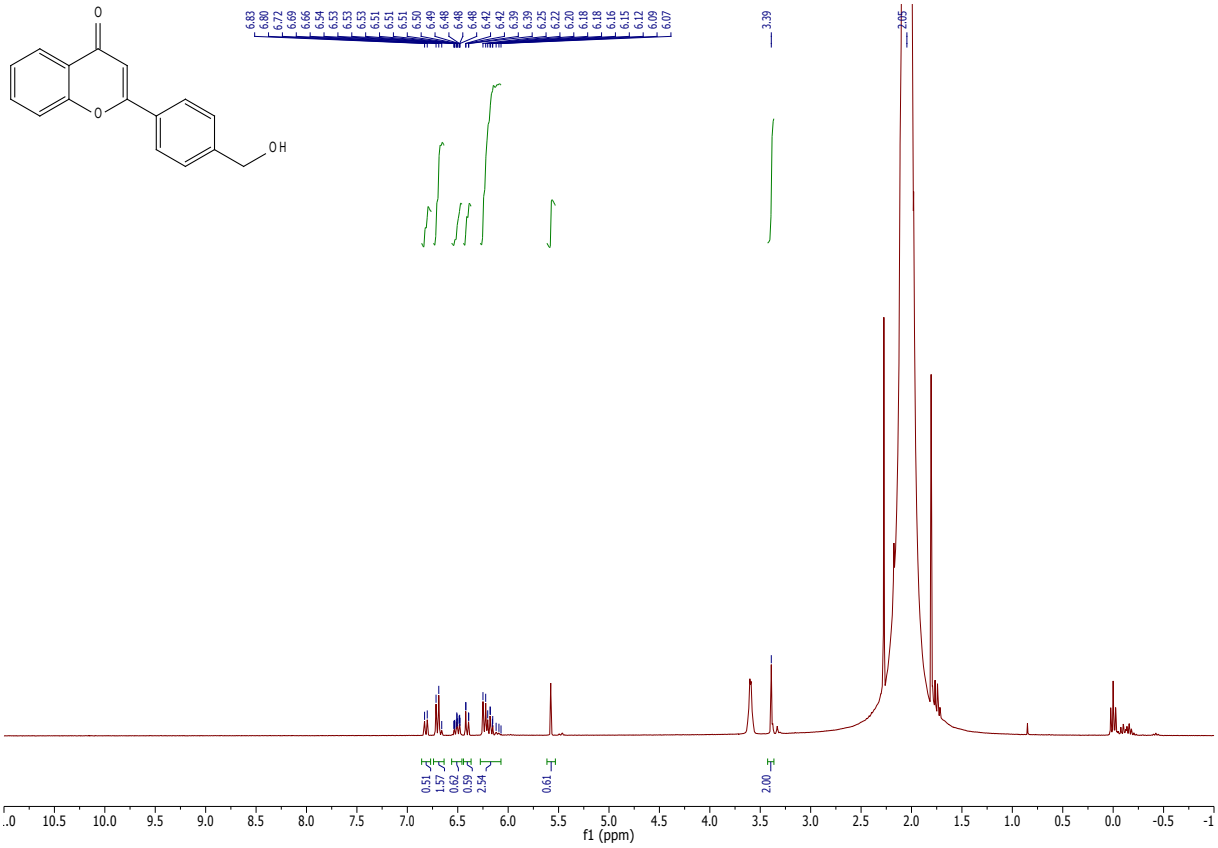

8.25
8.25
8.15
8.14
8.12
8.12
8.12
7.75
7.74
7.73
7.72
7.71
7.68
7.61
7.60
7.60
7.58
7.57
7.51
7.51
7.48
7.34
7.34
7.32
7.31
7.31
7.29
7.29
7.13
7.12
7.10
7.09
7.04
7.03
3.94
O
O
O
CH3

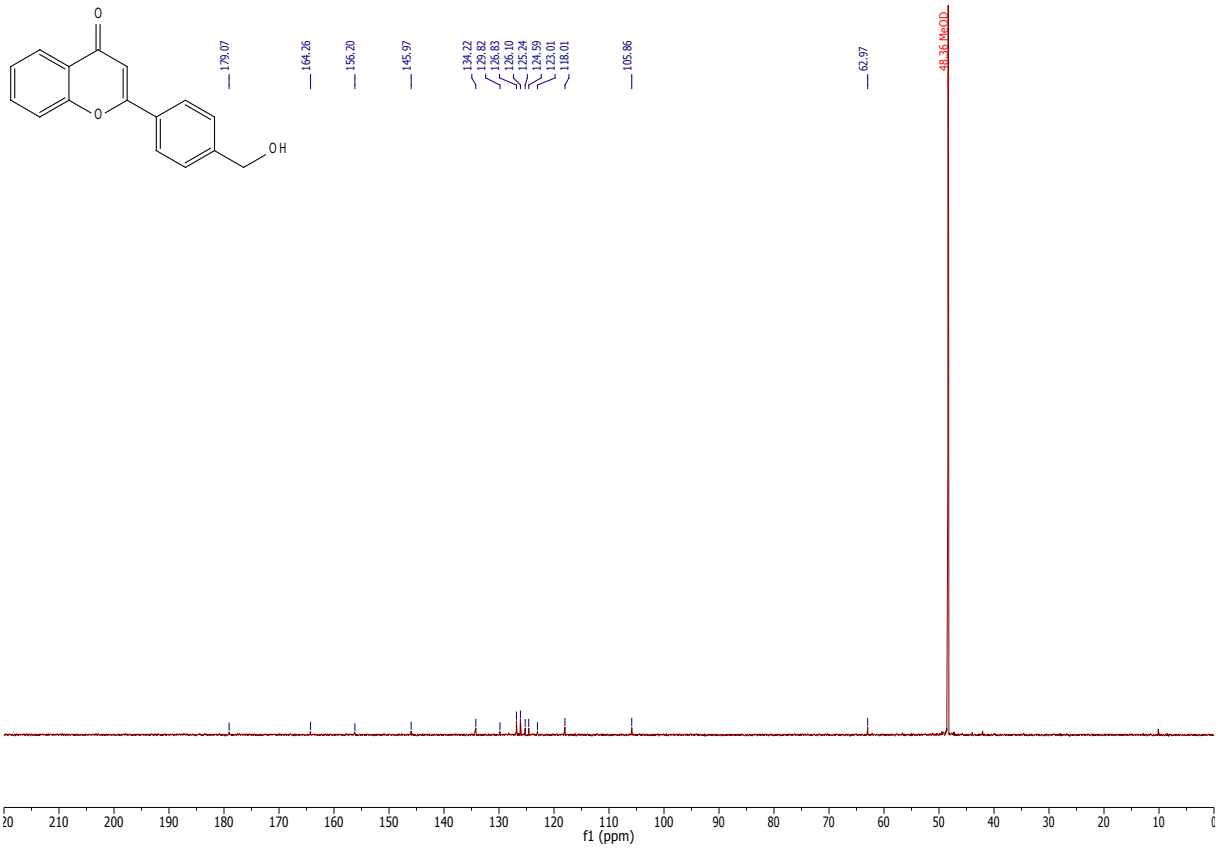

0.89
0.89
5.40
1.10
2.34
0.94
2.90
f1 (ppm)

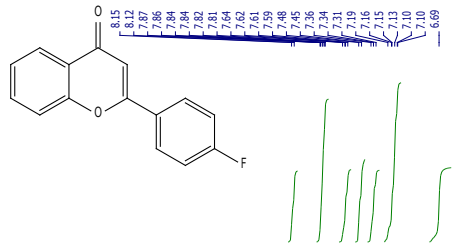
6.
O
O
O
CH3

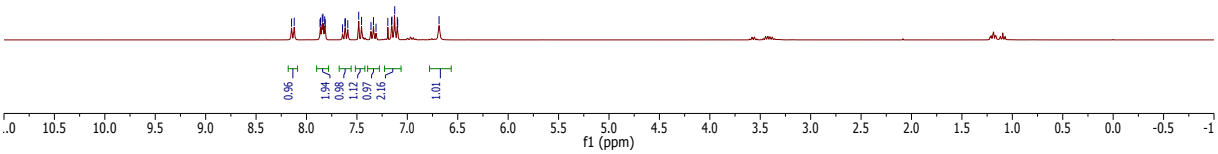

178.43
163.55
159.38
156.27
136.26
133.72
130.62
128.31
127.63
126.69
126.50
125.67
125.16
123.98
123.09
120.02
118.08
107.10
105.77
77.54
77.11 CDCl3
76.69 CDCl3
55.46
f1 (ppm)

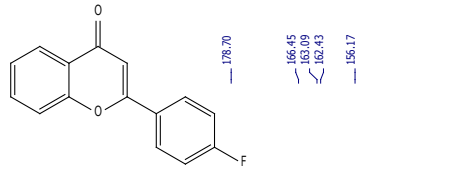

Abundance
Scan 7337 (39.192 min): zf-200-3.D\data.ms
302.1
139.1
182.1
231.1
259.1
202.1
63.1
92.1
115.6
157.1
285.1
341.1358.0 377.0
405.0
429.1
m/z-->

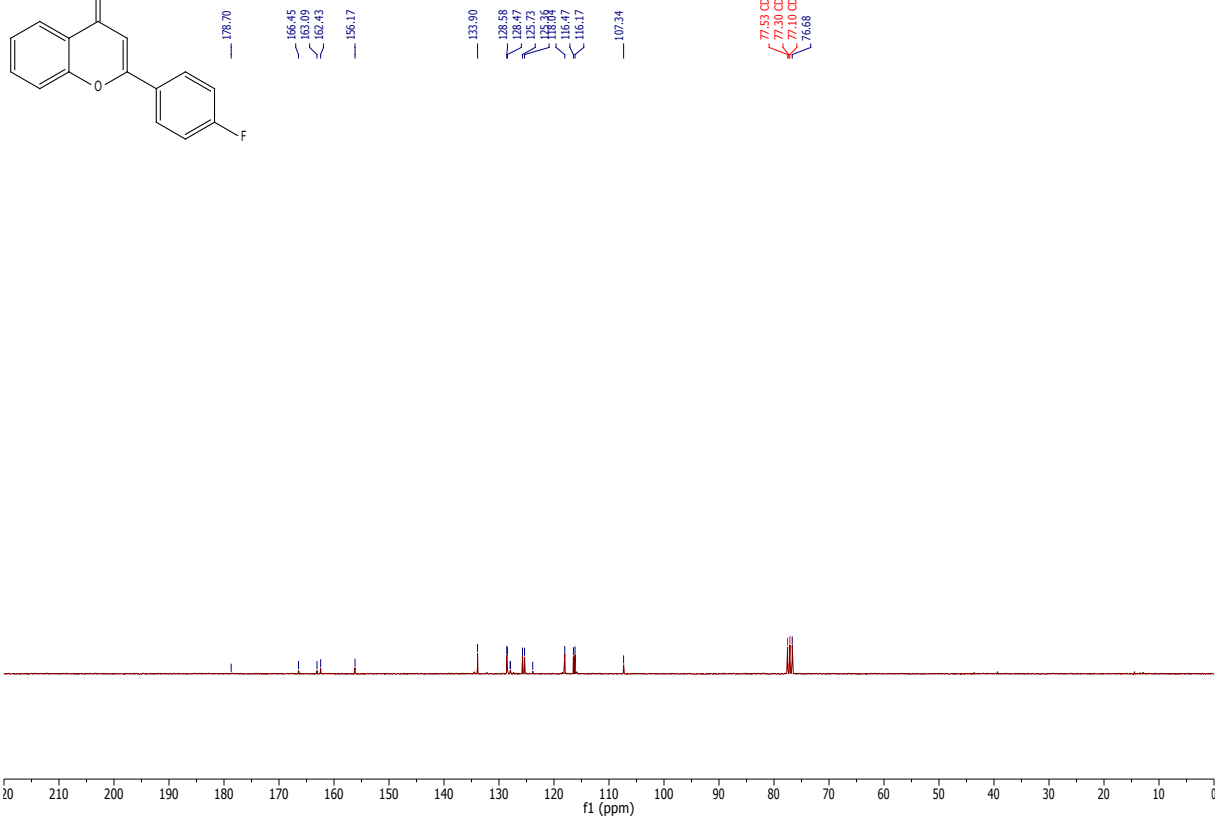

O
O
OH
6.83
6.80
6.72
6.69
6.66
6.54
6.53
6.53
6.51
6.51
6.50
6.49
6.48
6.48
6.42
6.42
6.39
6.25
6.22
6.20
6.18
6.18
6.16
6.15
6.12
6.09
6.07
3.39
2.05
0.51
1.57
0.62
0.59
2.54
0.61
2.00
f1 (ppm)

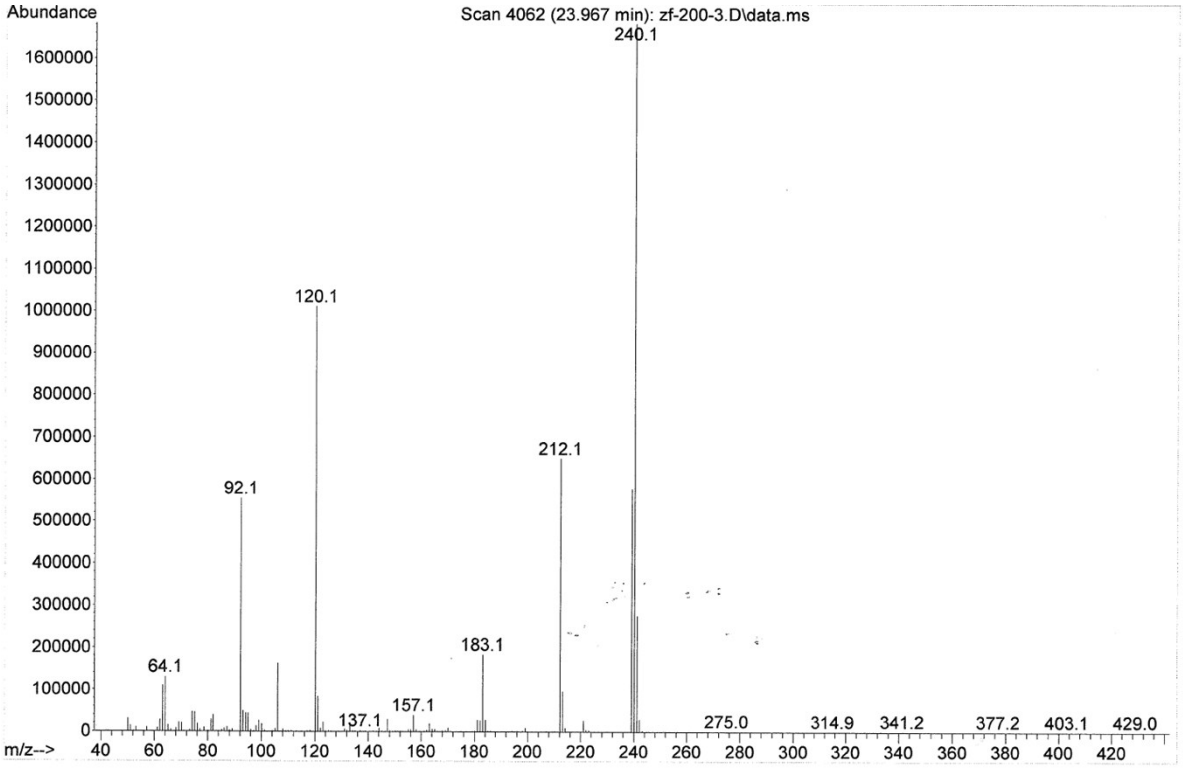

O
O
O H
179.07
164.26
156.20
145.97
134.22
129.82
126.83
126.10
125.24
124.59
123.01
118.01
105.86
62.97
48.36 MeOD
f1 (ppm)

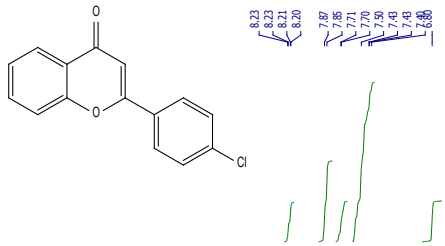

O
O
F
8.15
8.12
7.87
7.86
7.84
7.84
7.82
7.81
7.64
7.62
7.61
7.59
7.48
7.45
7.36
7.34
7.31
7.19
7.16
7.15
7.13
7.10
7.10
6.69

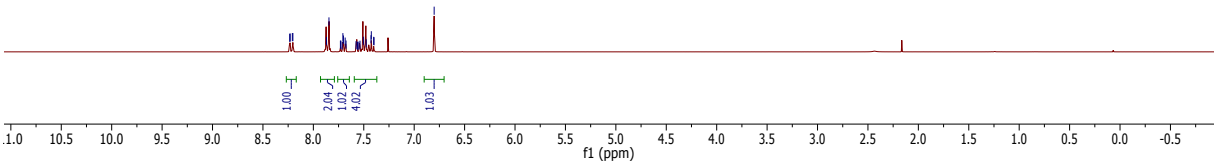

0.96
1.94
0.98
1.12
0.97
2.16
1.01
f1 (ppm)

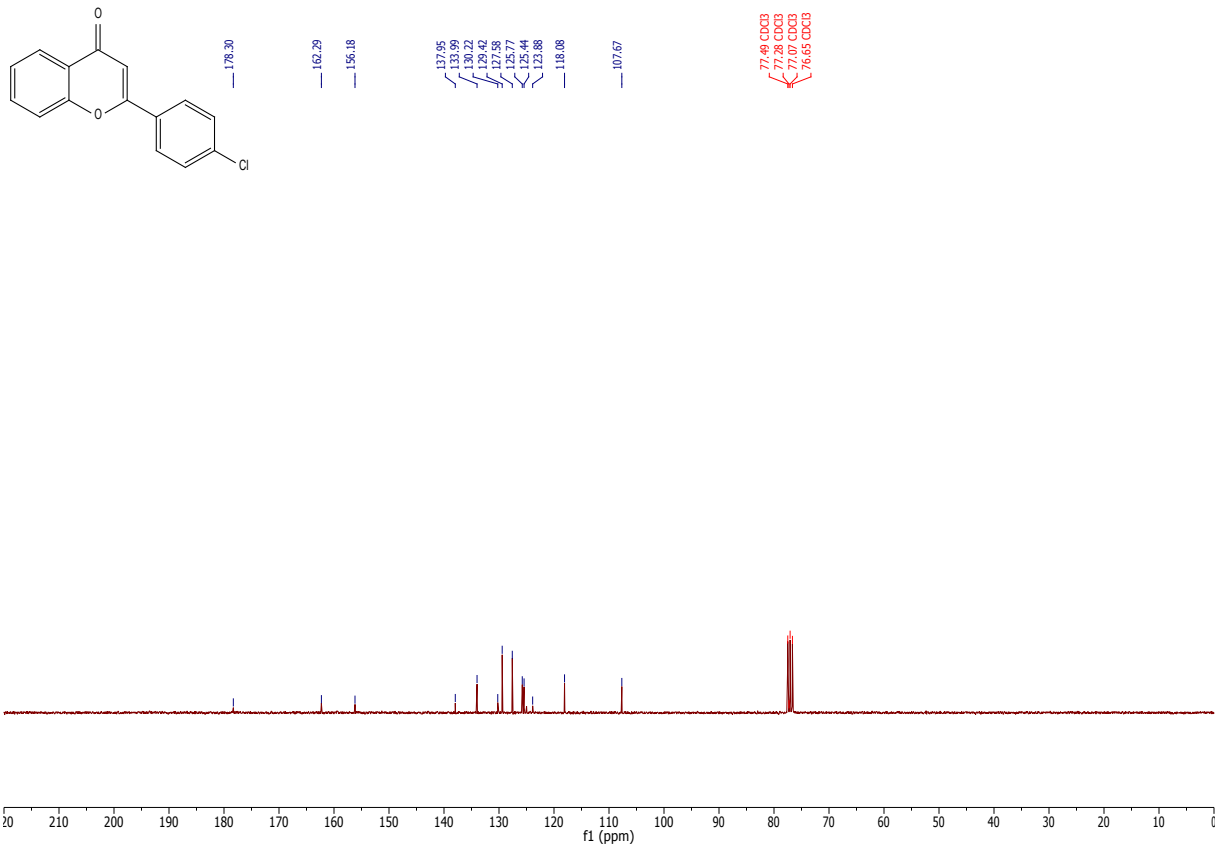

O
O
F

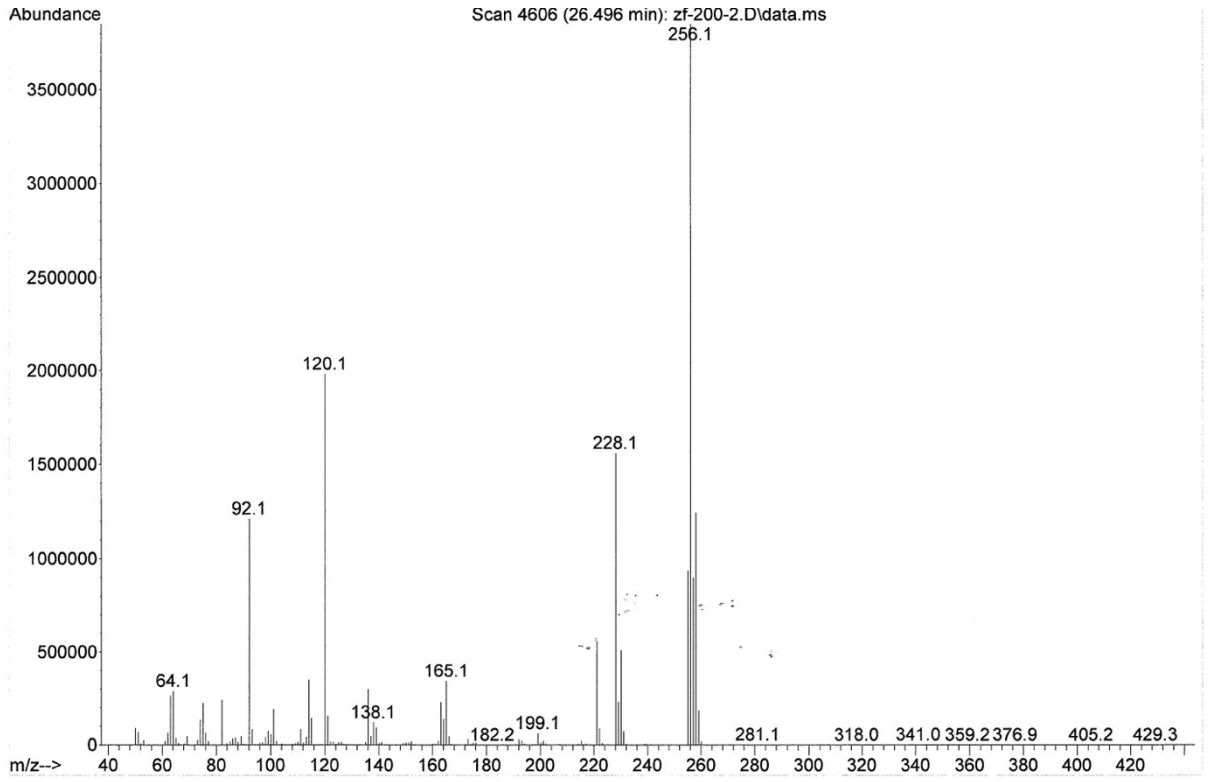

178.70
166.45
163.49
162.43
156.17
133.90
128.58
128.47
125.73
116.47
116.17
107.34
77.53 CDCl3
77.30 CDCl3
77.10 CDCl3
76.68
f1 (ppm)

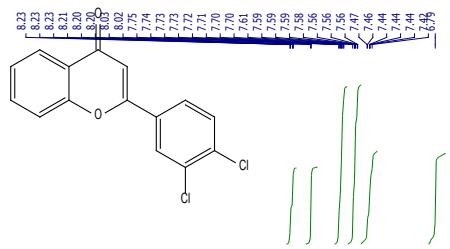

Abundance
Scan 4062 (23.967 min): zf-200-3.D\data.ms
240.1
120.1
212.1
92.1
183.1
64.1
157.1
137.1
275.0
314.9
341.2
377.2
403.1
429.0
m/z-->

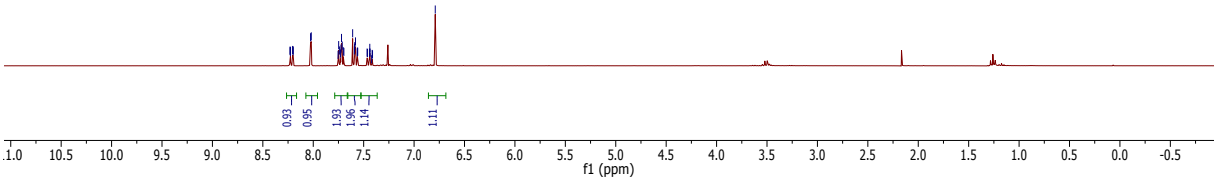

O
O
Cl

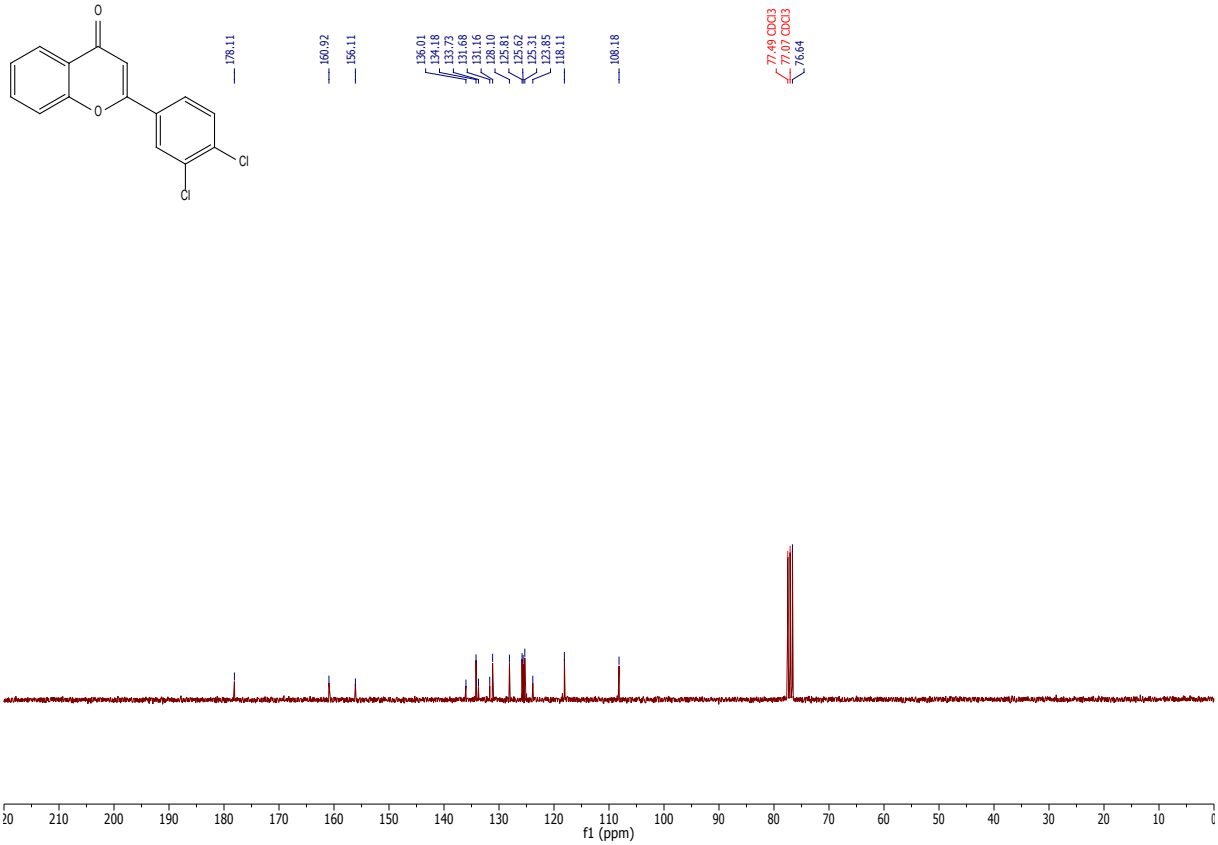

1.00
2.04
1.02
4.02
1.03
f1 (ppm)

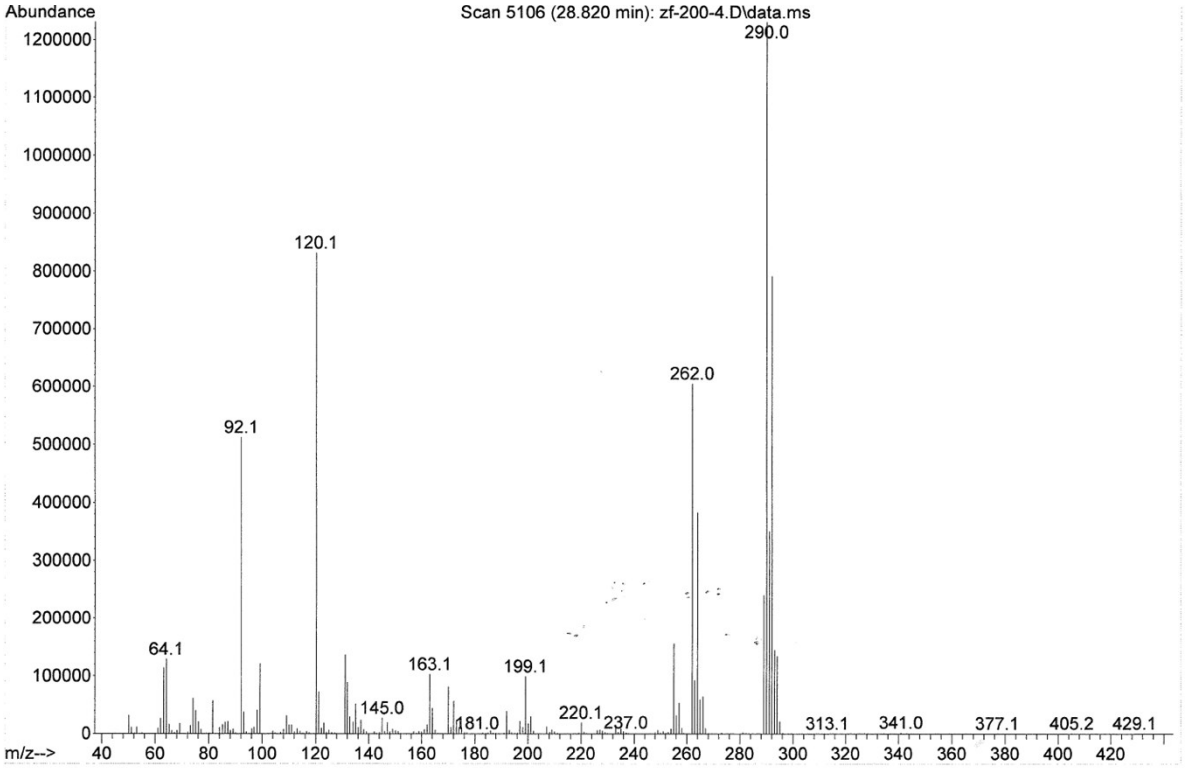

O
O
Cl
178.30
162.29
156.18
137.95
133.99
130.22
129.42
127.58
125.77
125.44
123.88
118.08
107.67
77.49 CDCl3
77.28 CDCl3
77.07 CDCl3
76.65 CDCl3
f1 (ppm)


Abundance
Scan 4606 (26.496 min): zf-200-2.D\data.ms
256.1
120.1
228.1
92.1
64.1
165.1
138.1
182.2
199.1
281.1
318.0
341.0
359.2
376.9
405.2
429.3
m/z-->

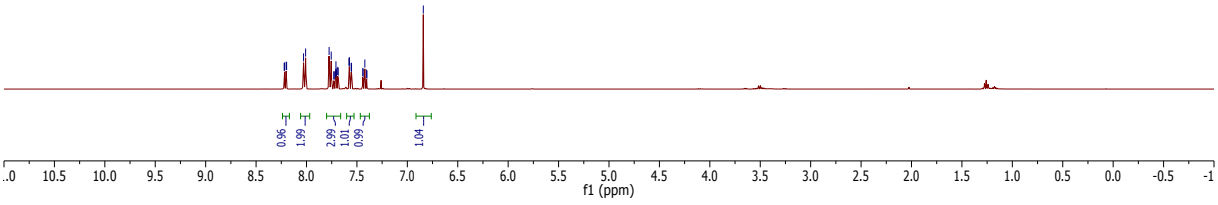

8.23
8.23
8.23
8.21
8.20
8.20
8.03
8.02
7.75
7.74
7.73
7.73
7.72
7.71
7.70
7.70
7.61
7.59
7.59
7.59
7.58
7.56
7.56
7.56
7.47
7.46
7.44
7.44
7.44
7.42
6.79
O
O
Cl
Cl

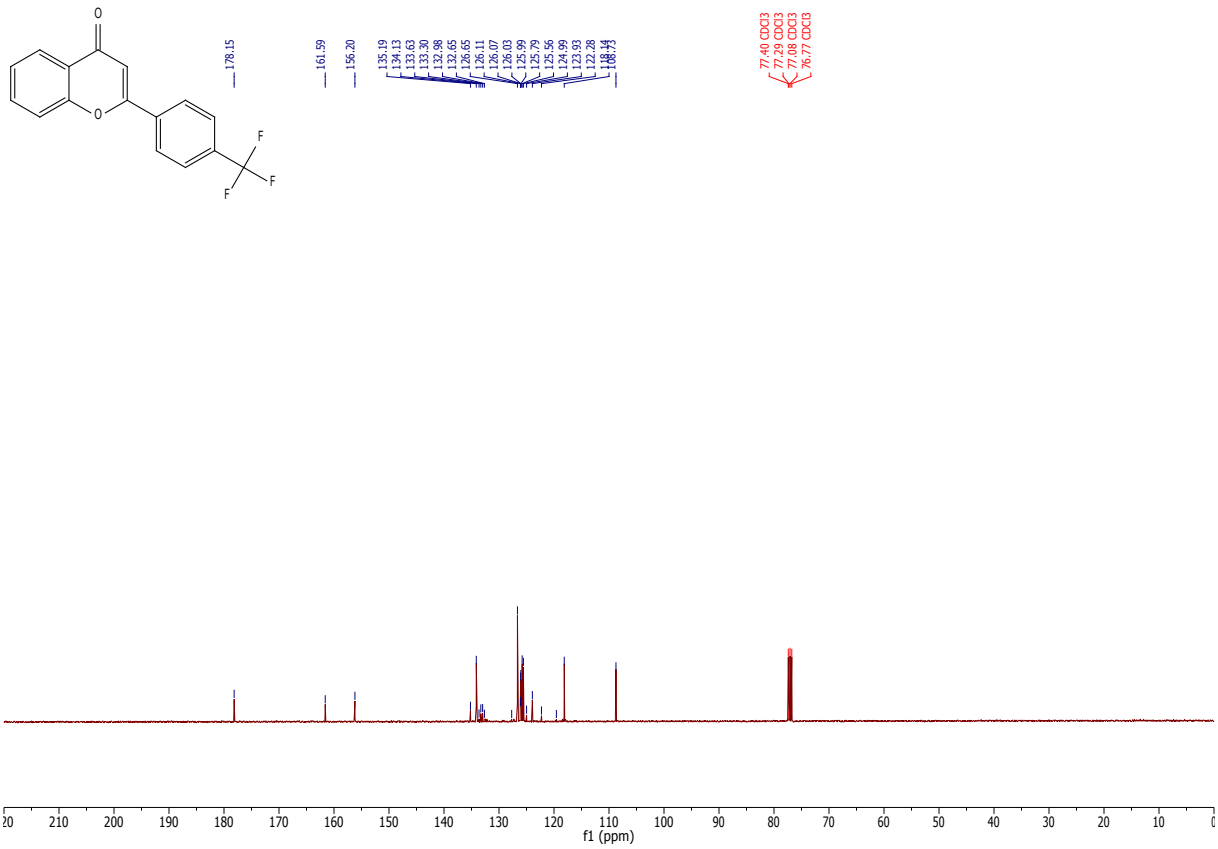

0.93
0.95
1.93
1.96
1.14
1.11
f1 (ppm)

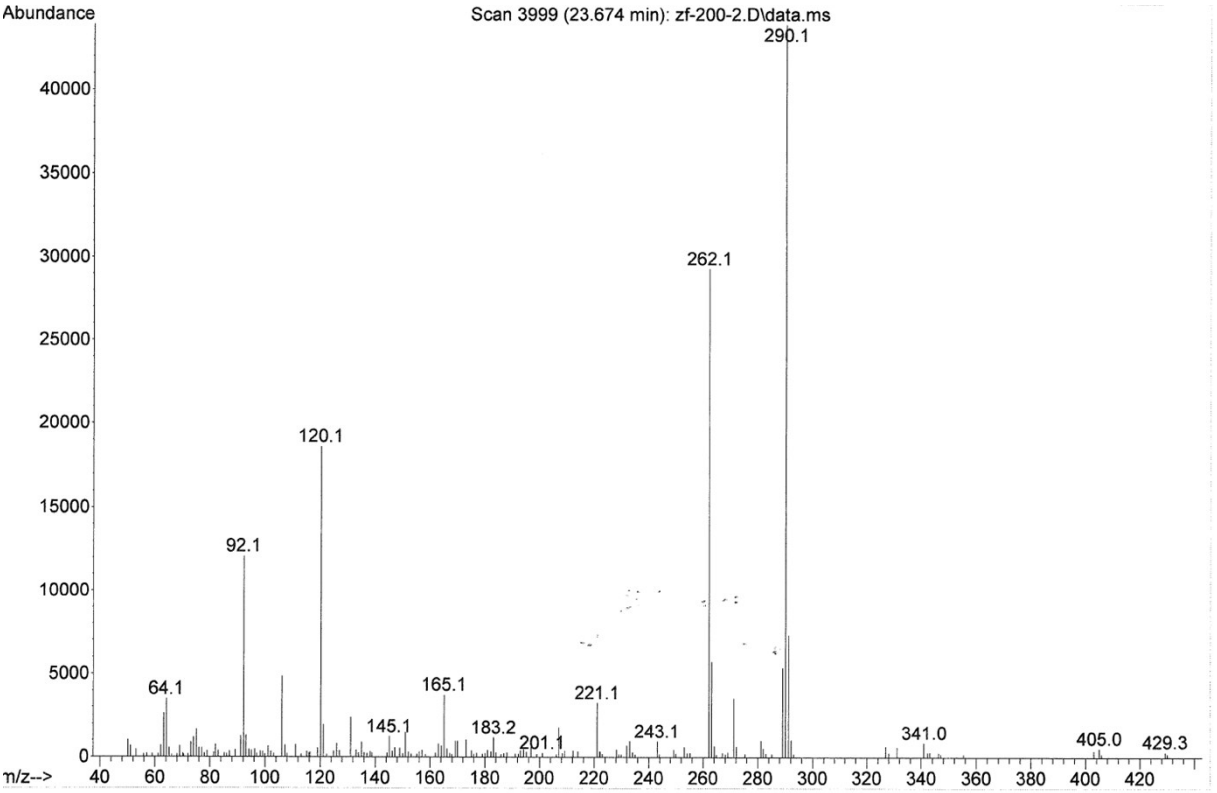

O
O
Cl
Cl
178.11
160.92
156.11
136.01
134.18
133.73
131.68
131.16
128.10
125.81
125.62
125.31
123.85
118.11
108.18
77.49 CDCl3
77.07 CDCl3
76.64
f1 (ppm)

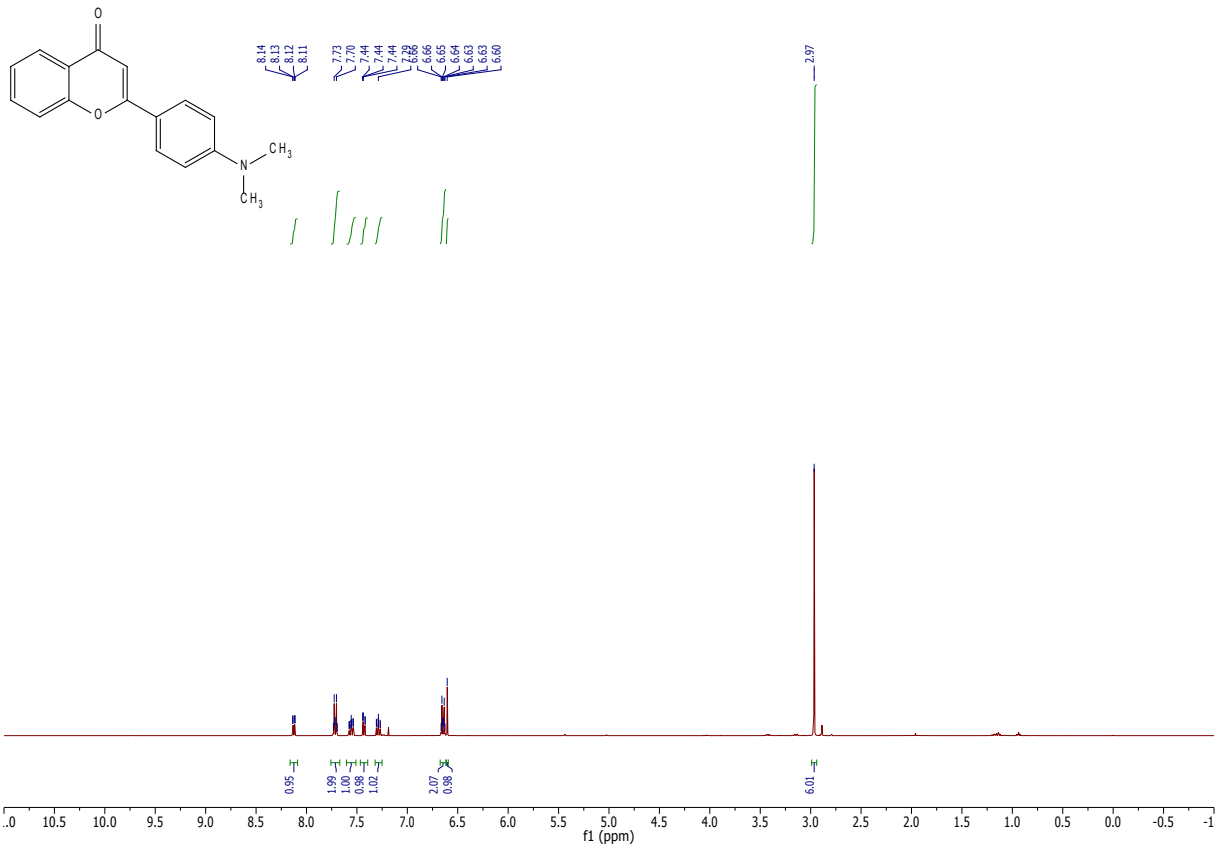

Abundance
Scan 5106 (28.820 min): zf-200-4.D\data.ms
290.0
120.1
262.0
92.1
64.1
163.1
199.1
145.0
181.0
220.1
237.0
313.1
341.0
377.1
405.2
429.1
m/z-->

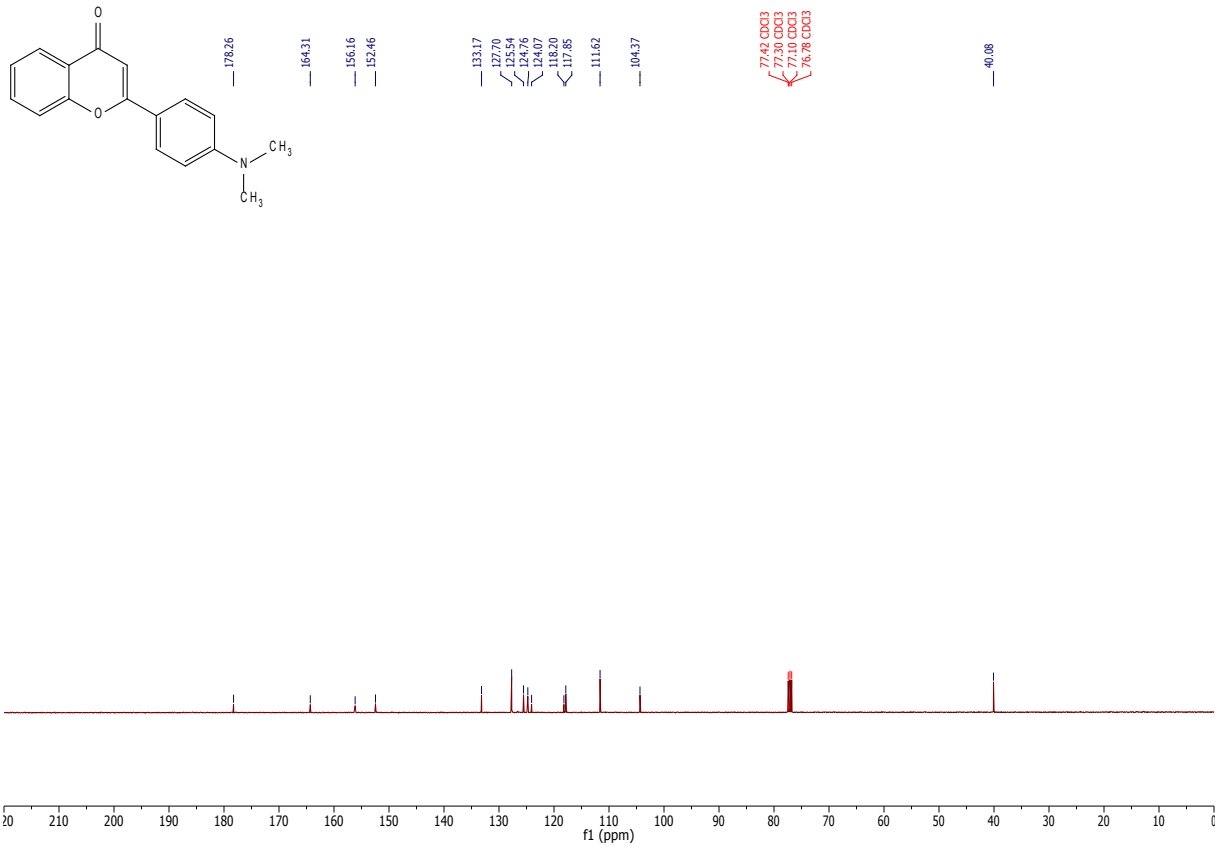

8.22
8.22
8.20
8.03
8.01
7.78
7.75
7.73
7.72
7.71
7.71
7.70
7.69
7.69
7.58
7.58
7.57
7.56
7.55
7.55
7.44
7.44
7.42
7.40
7.40
6.84
O
F
F
F

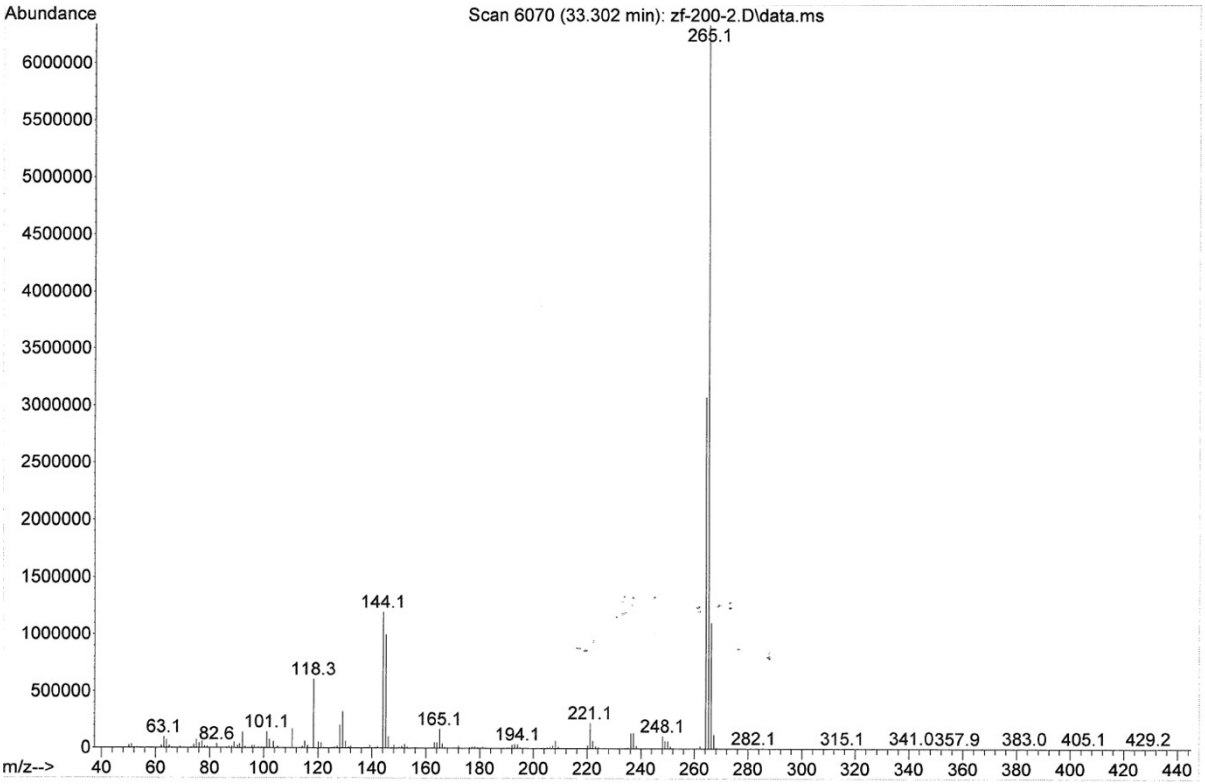

0.96
1.99
2.99
1.01
0.99
1.04
f1 (ppm)

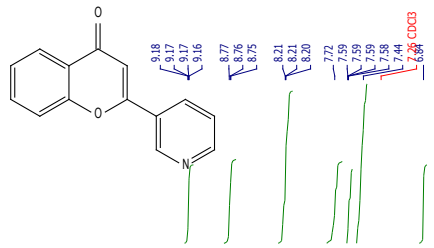

O
O
F
F
F
178.15
161.59
156.20
135.19
134.13
133.63
133.30
132.98
132.65
126.65
126.11
126.07
126.03
125.99
125.79
125.56
124.99
123.93
122.28
118.44
118.13
77.40 CDCl3
77.29 CDCl3
77.08 CDCl3
76.77 CDCl3
f1 (ppm)

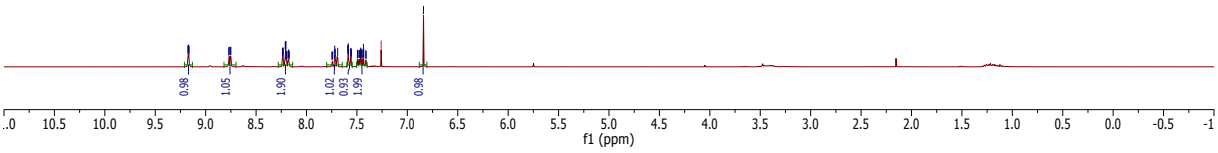

Abundance
Scan 3999 (23.674 min): zf-200-2.D\data.ms
290.1
262.1
120.1
92.1
64.1
165.1
221.1
145.1
183.2
201.1
243.1
341.0
405.0
429.3
m/z-->

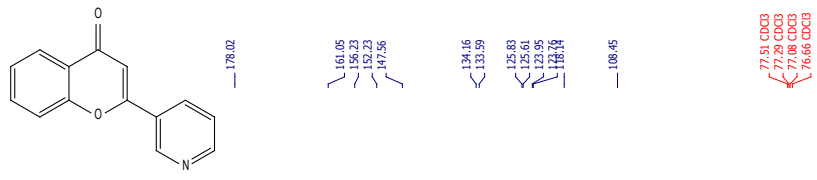

O
O
N
CH3
CH3
8.14
8.13
8.12
8.11
7.73
7.70
7.44
7.44
7.44
7.44
6.66
6.65
6.64
6.63
6.63
6.60
2.97
0.95
1.99
1.00
0.98
1.02
2.07
0.98
6.01
f1 (ppm)

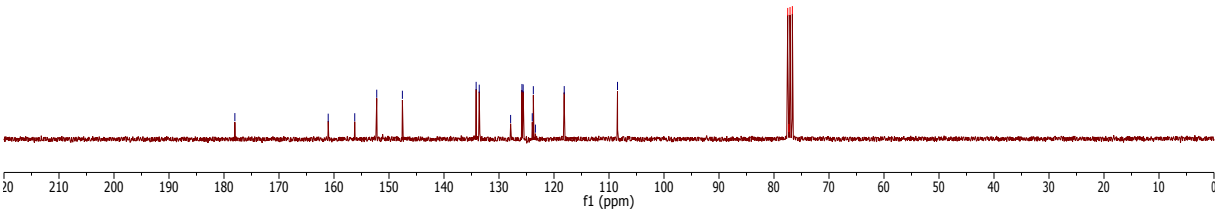

O
O
N
CH3
CH3
178.26
164.31
156.16
152.46
133.17
127.70
125.54
124.76
124.07
118.20
117.85
111.62
104.37
77.42 CDCl3
77.30 CDCl3
77.10 CDCl3
76.78 CDCl3
40.08
f1 (ppm)

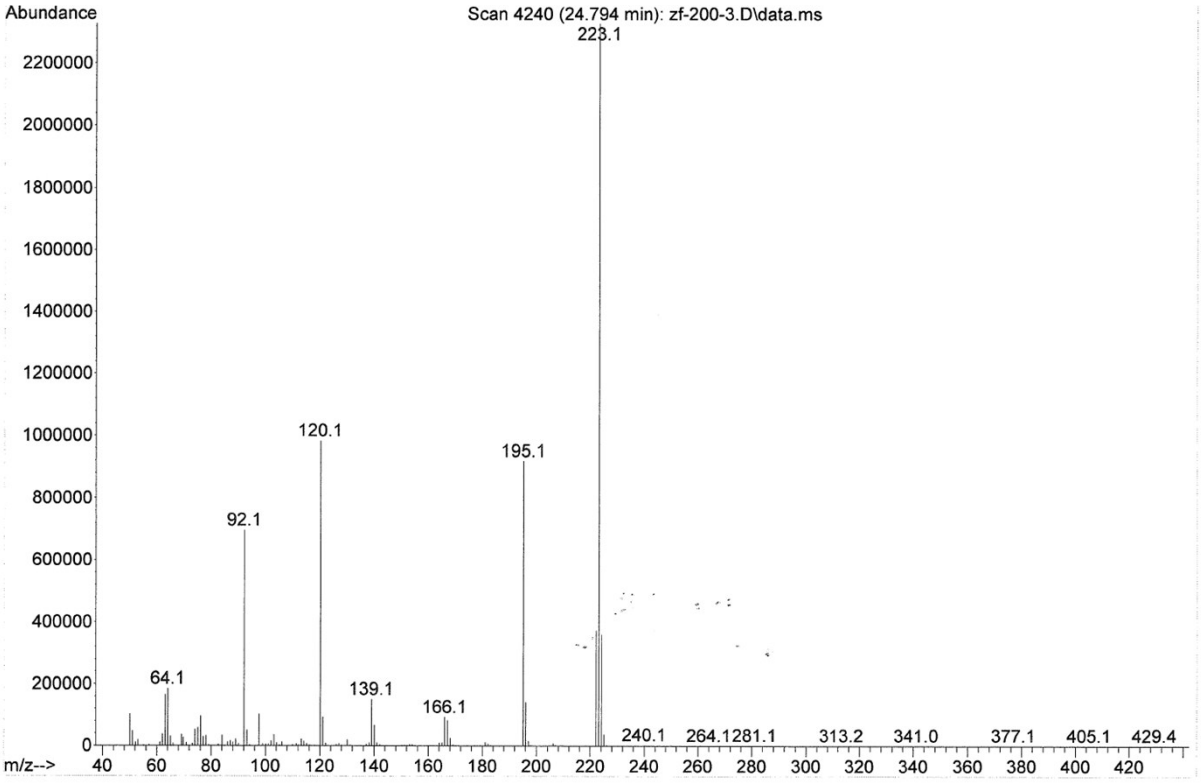

Abundance
Scan 6070 (33.302 min): zf-200-2.D\data.ms
265.1
144.1
118.3
63.1
82.6
101.1
165.1
194.1
221.1
248.1
282.1
315.1
341.0357.9
383.0
405.1
429.2
m/z-->


O
O
N
9.18
9.17
9.17
9.16
8.77
8.76
8.75
8.21
8.21
8.20
7.72
7.59
7.59
7.59
7.58
7.44
7.26 CDCl3
6.84

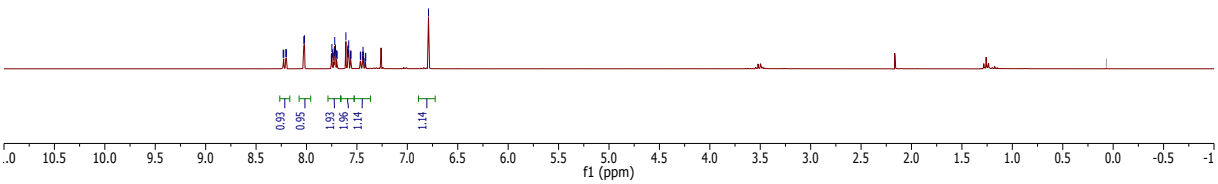

0.98
1.05
1.90
1.02
0.93
1.99
0.98
f1 (ppm)

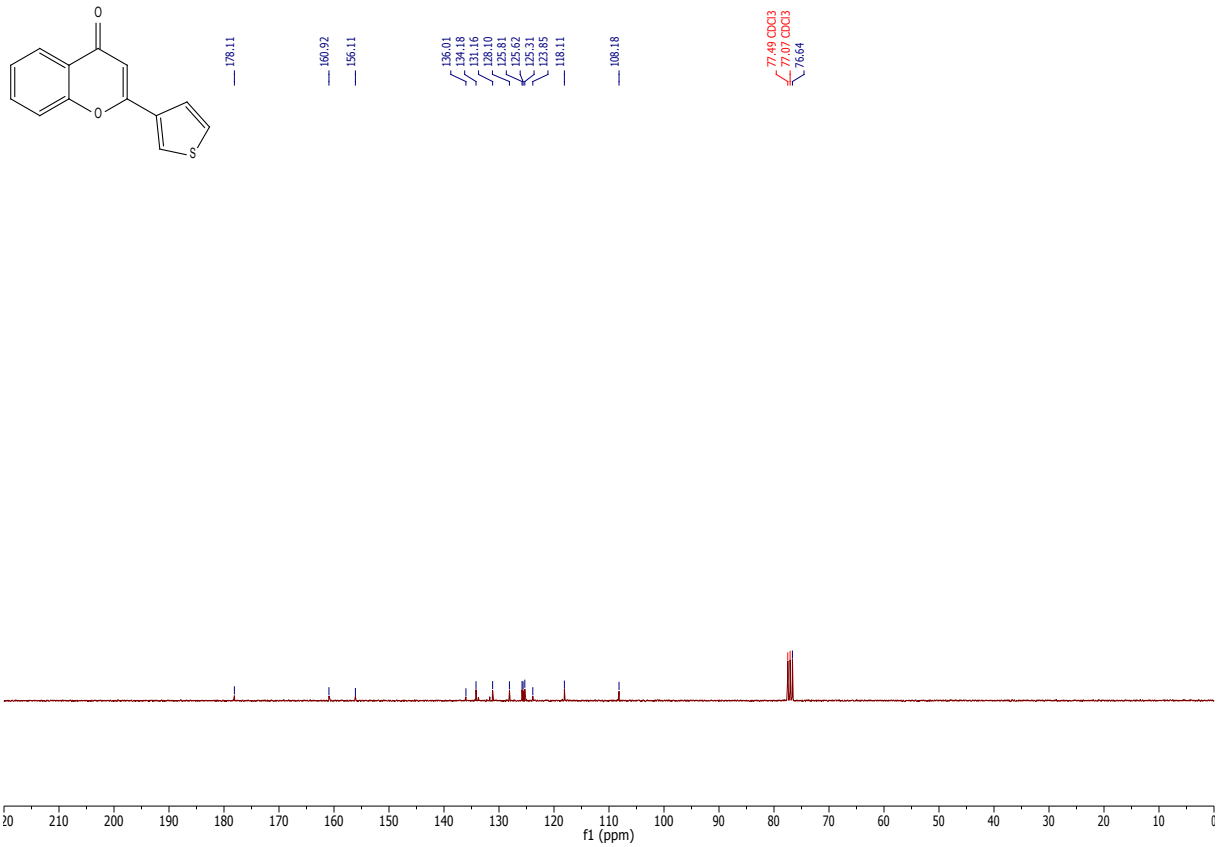

O
O
N
178.02
161.05
156.23
152.23
147.56
134.16
133.59
125.83
125.61
123.95
123.76
118.14
108.45
77.51 CDCl3
77.29 CDCl3
77.08 CDCl3
76.66 CDCl3

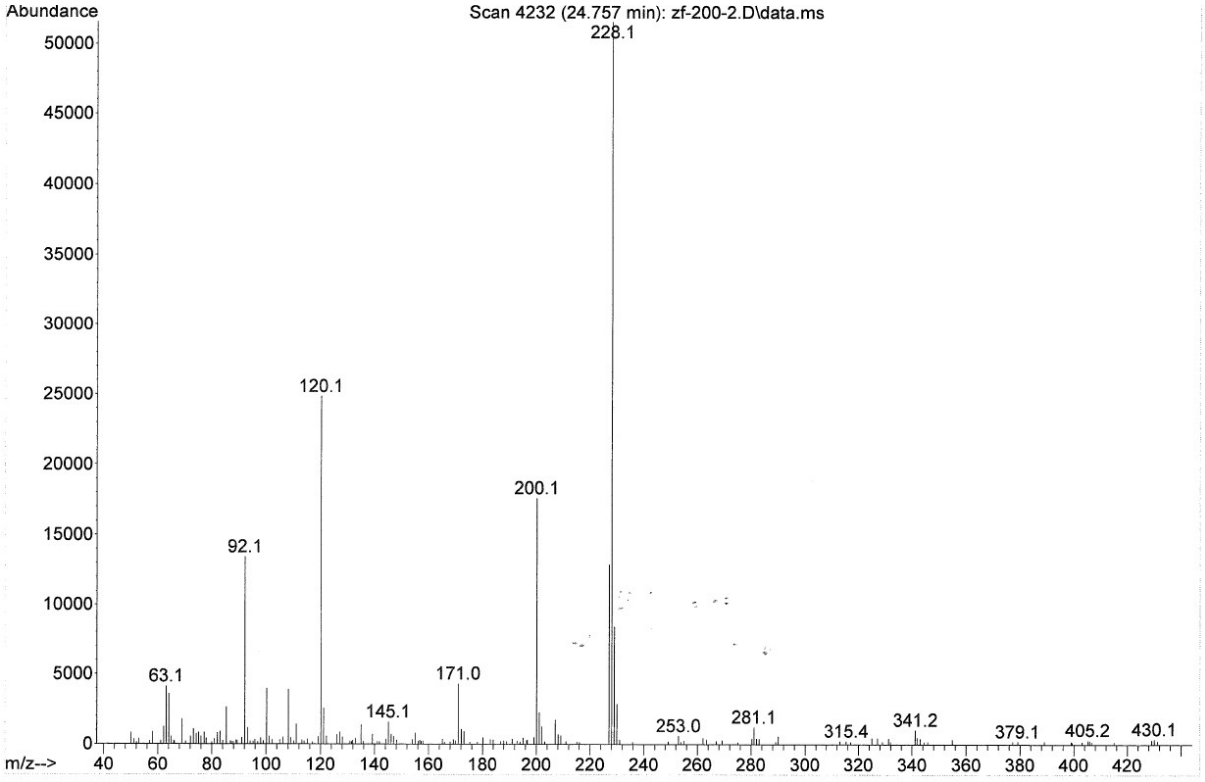

f1 (ppm)

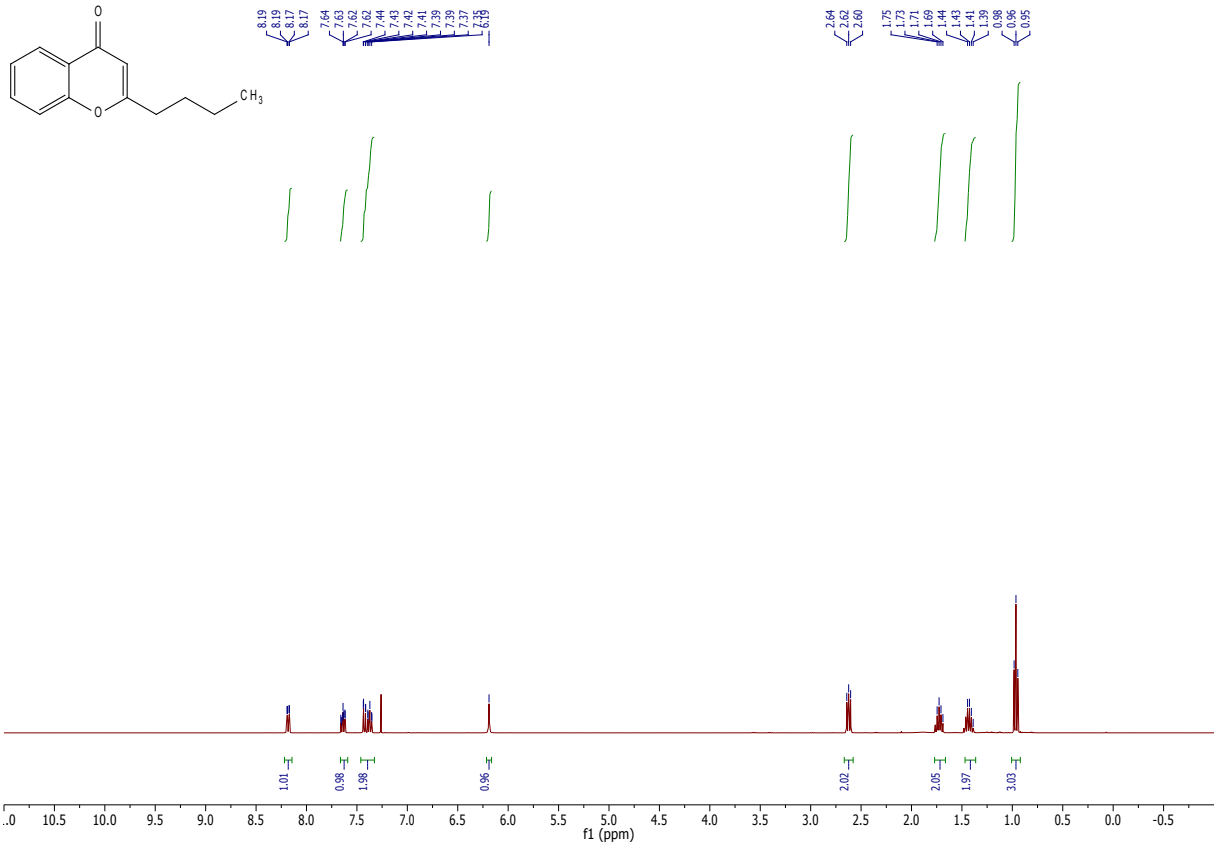

Abundance
Scan 4240 (24.794 min): zf-200-3.D\data.ms
223.1
120.1
195.1
92.1
64.1
139.1
166.1
240.1
264.1
281.1
313.2
341.0
377.1
405.1
429.4
m/z-->


8.23
8.23
8.21
8.20
8.03
8.02
7.75
7.74
7.73
7.73
7.72
7.71
7.70
7.70
7.61
7.59
7.59
7.59
7.58
7.56
7.56
7.56
7.47
7.46
7.44
7.44
7.44
7.42
6.75
O
O
S

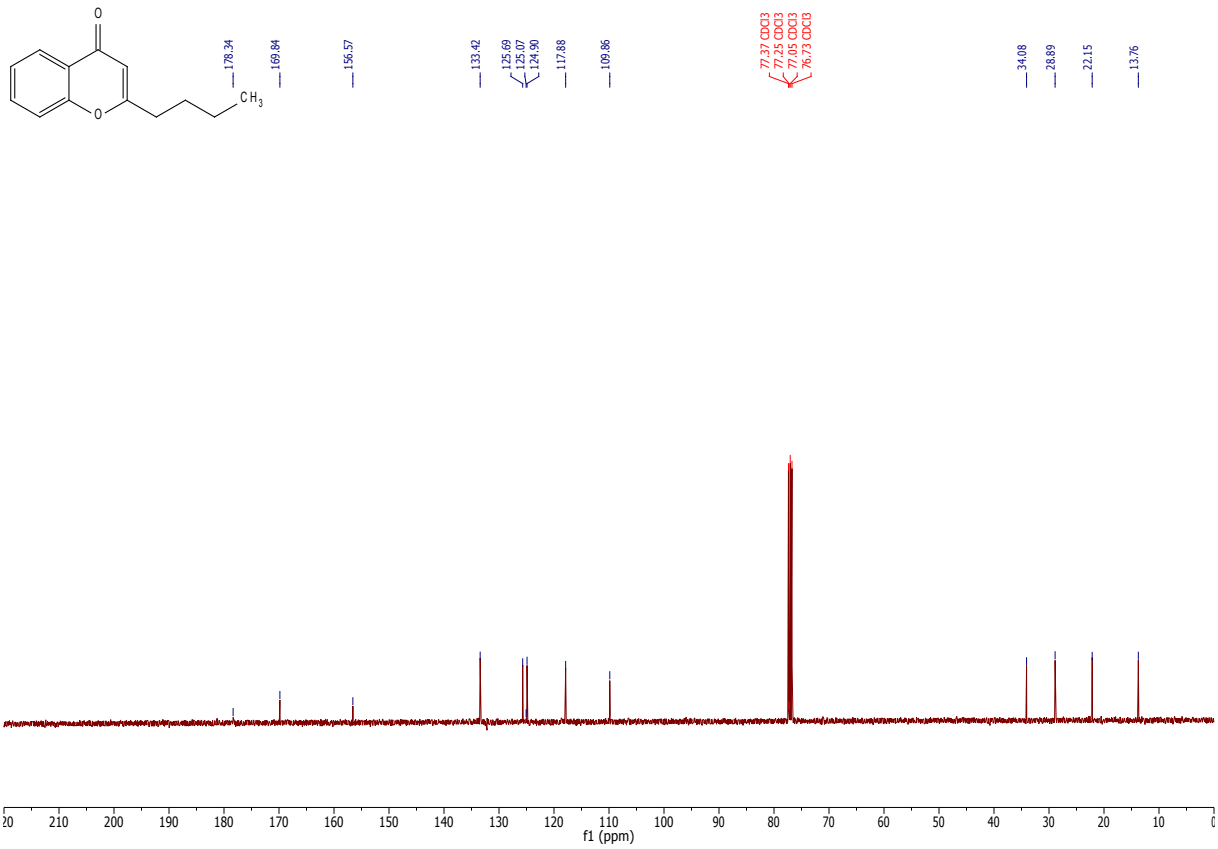

0.93
0.95
1.93
1.96
1.14
1.14
f1 (ppm)

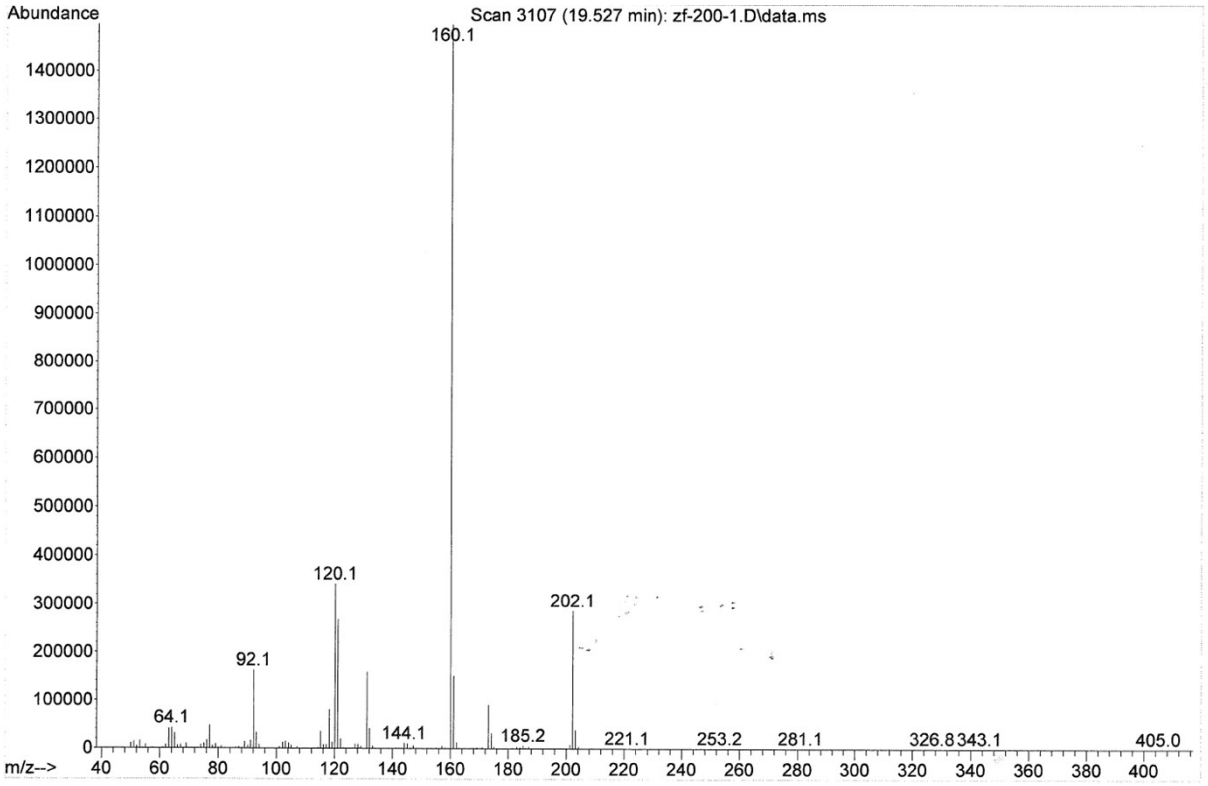

O
O
S
178.11
160.92
156.11
136.01
134.18
131.16
128.10
125.81
125.62
125.31
123.85
118.11
108.18
77.49 CDCl3
77.07 CDCl3
76.64
f1 (ppm)

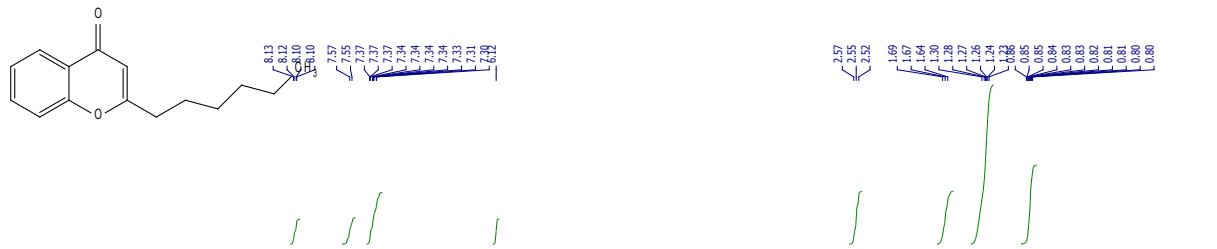

Abundance
Scan 4232 (24.757 min): zf-200-2.D\data.ms
228.1
120.1
200.1
92.1
63.1
171.0
145.1
253.0
281.1
315.4
341.2
379.1
405.2
430.1
m/z-->

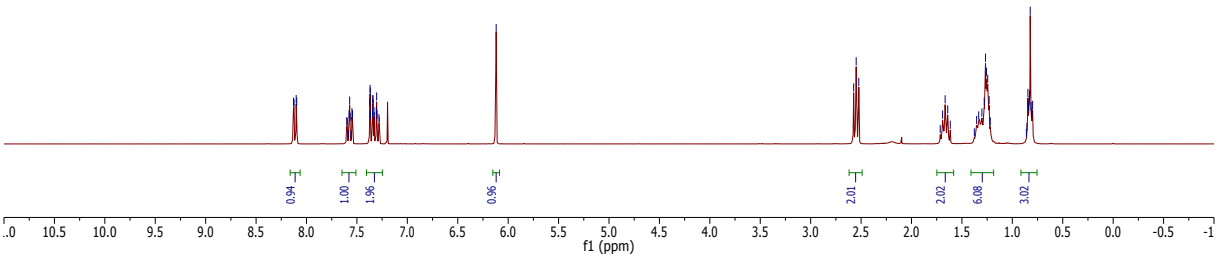

O
O
CH3
8.19
8.19
8.17
8.17
7.64
7.63
7.62
7.62
7.44
7.43
7.42
7.41
7.39
7.39
7.37
7.36
6.15
2.64
2.62
2.60
1.75
1.73
1.71
1.69
1.44
1.43
1.41
1.39
0.98
0.96
0.95

1.01
0.98
1.98
0.96
2.02
2.05
1.97
3.03
f1 (ppm)

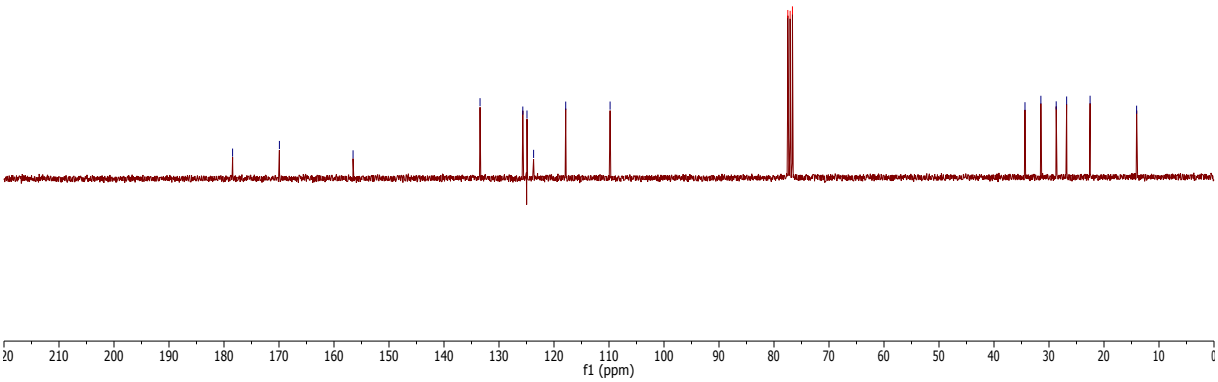

O
O
CH3
178.34
169.84
156.57
133.42
125.69
125.07
124.90
117.88
109.86
77.37 CDCl3
77.25 CDCl3
77.05 CDCl3
76.73 CDCl3
34.08
28.89
22.15
13.76
f1 (ppm)

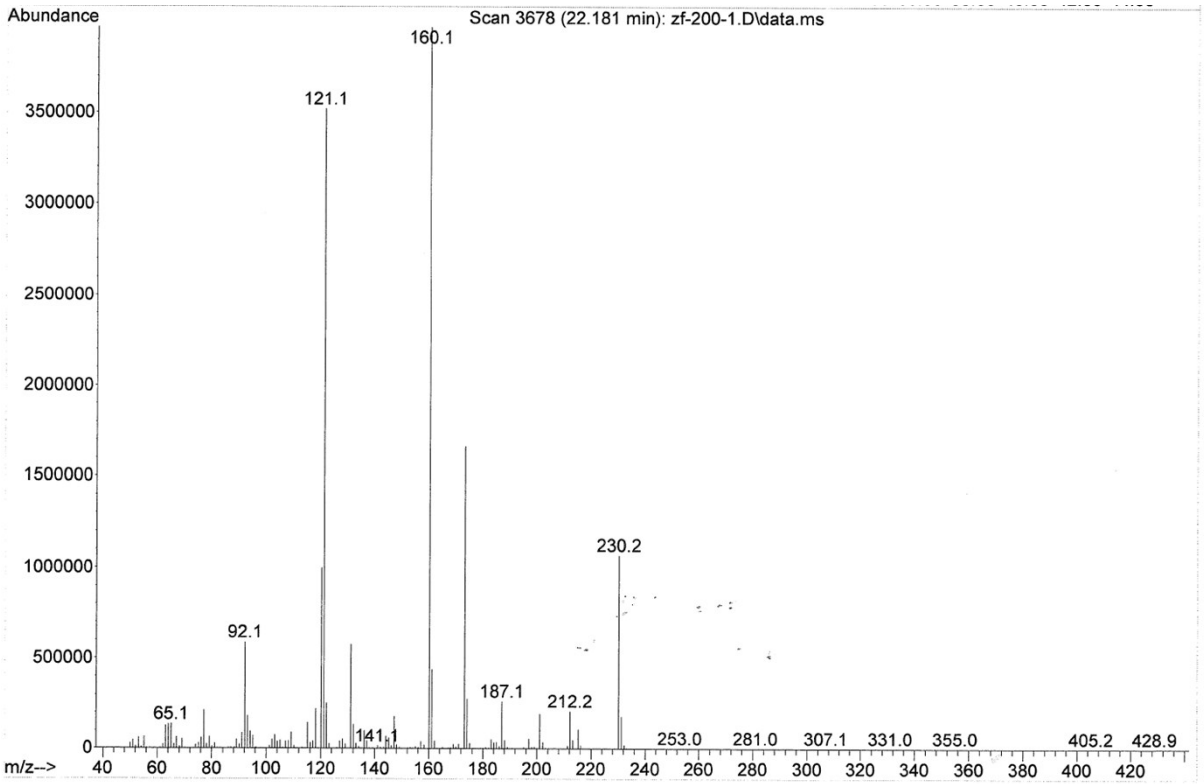

Abundance
Scan 3107 (19.527 min): zf-200-1.D\data.ms
160.1
120.1
202.1
92.1
64.1
144.1
185.2
221.1
253.2
281.1
326.8
343.1
405.0
m/z-->

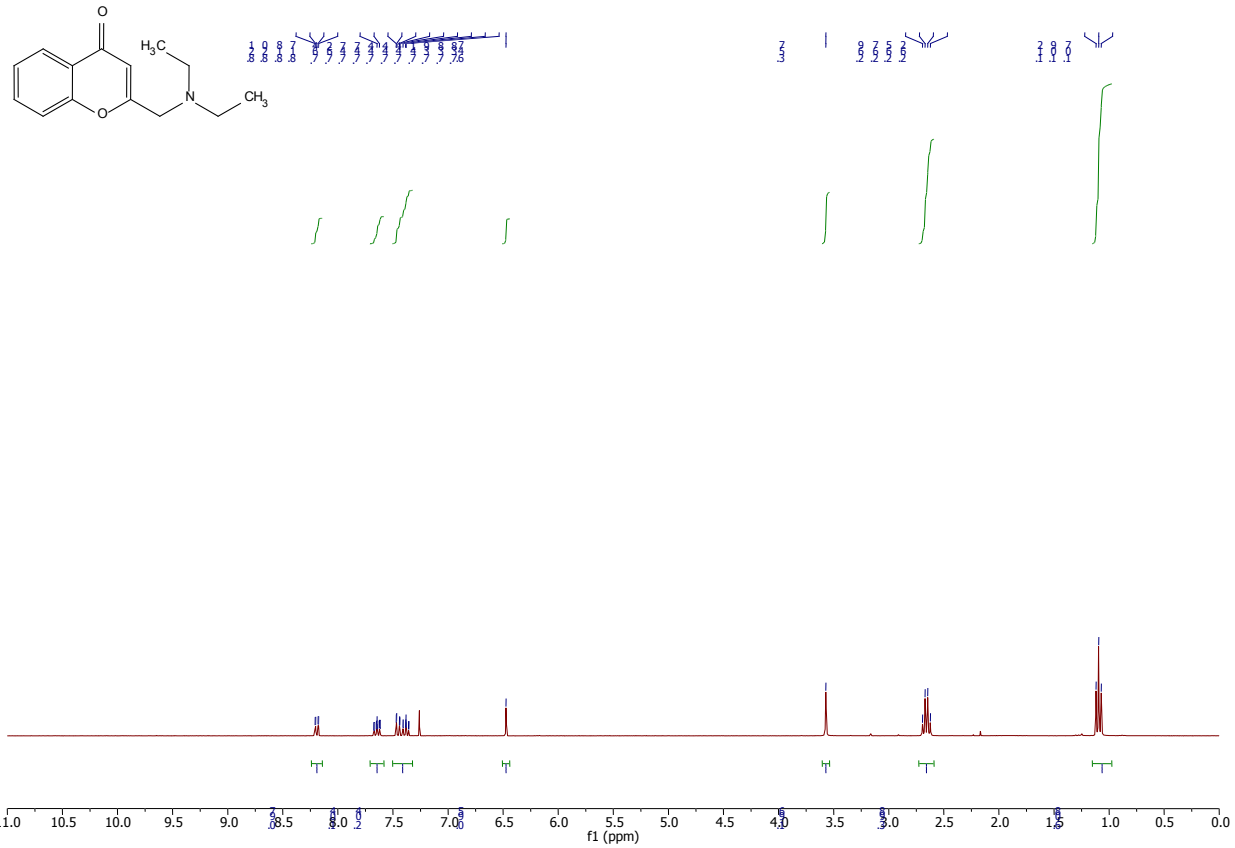

O
O
CH3
8.13
8.12
8.10
8.10
7.57
7.55
7.37
7.37
7.37
7.34
7.34
7.34
7.34
7.33
7.31
7.30
6.12
2.57
2.55
2.52
1.69
1.67
1.64
1.30
1.28
1.27
1.26
1.24
0.86
0.85
0.85
0.84
0.83
0.83
0.82
0.81
0.81
0.80
0.80

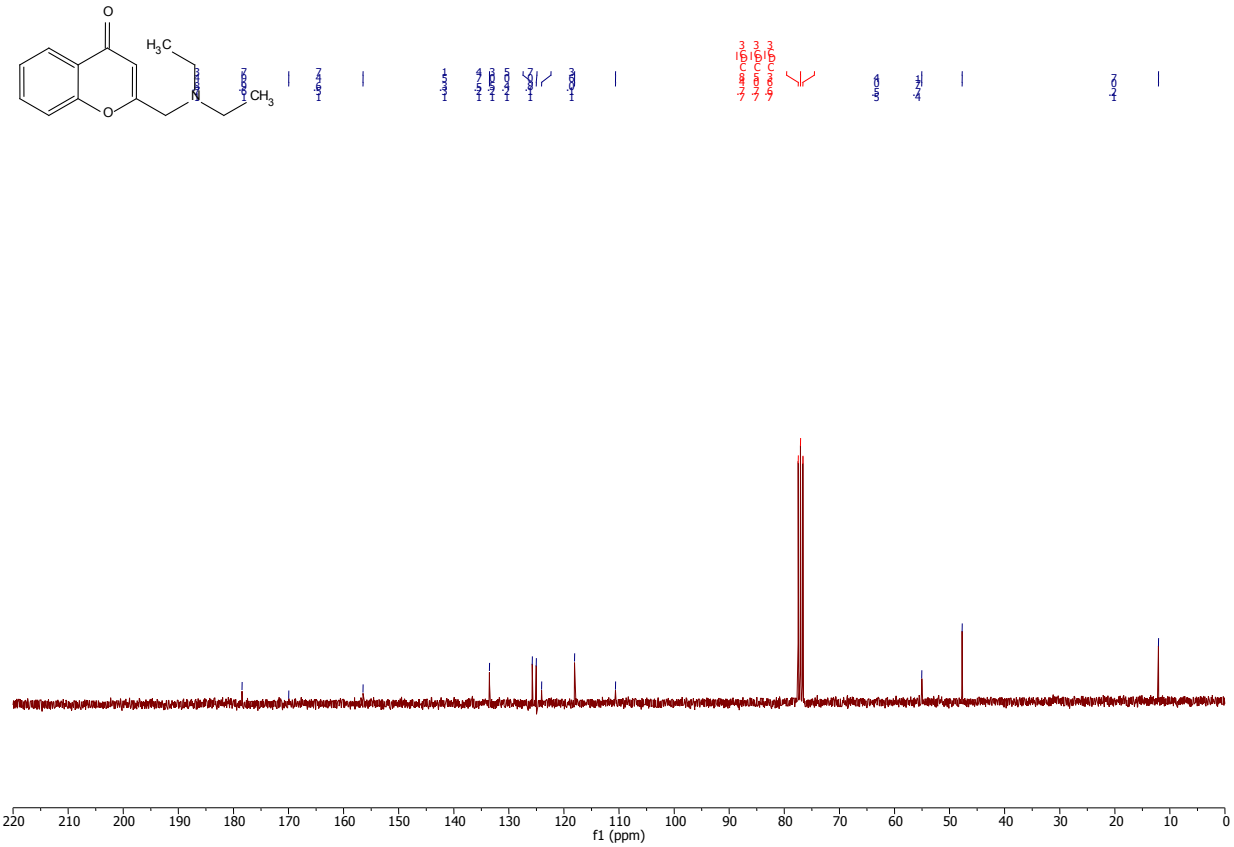

0.94
1.00
1.96
0.96
2.01
2.02
6.08
3.02
f1 (ppm)

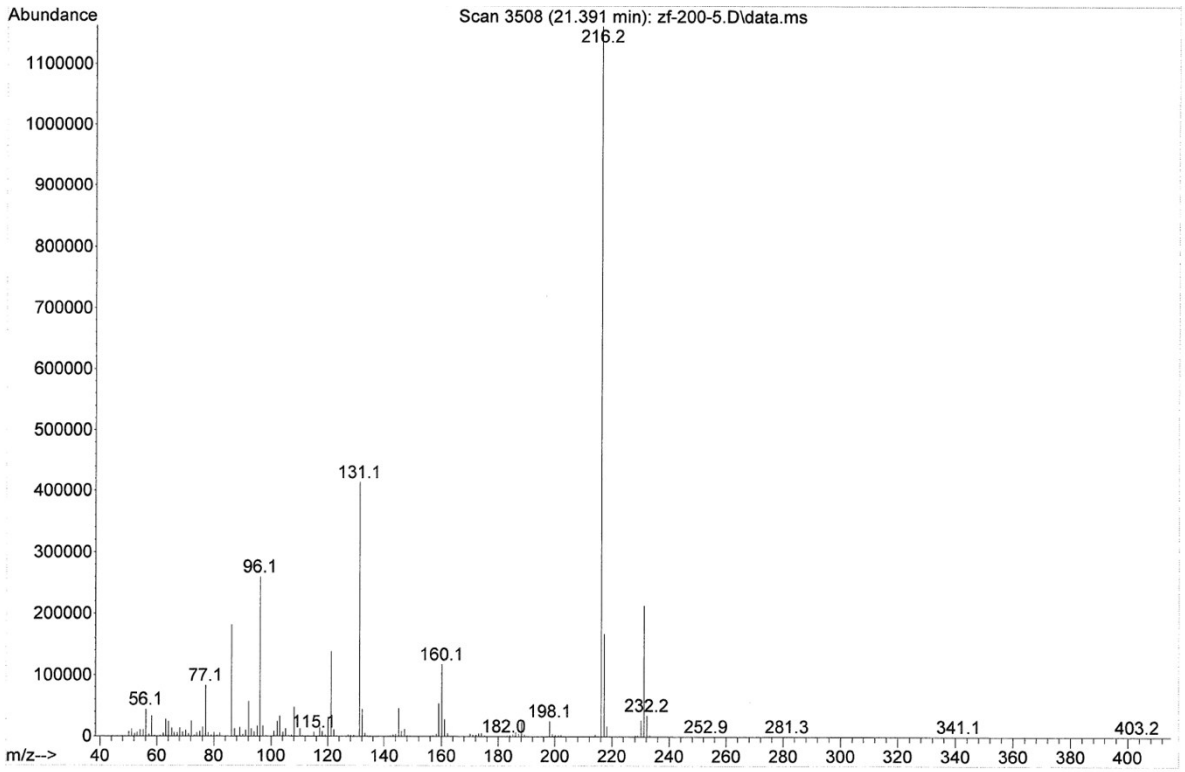

O
O
CH3
178.44
169.92
156.53
133.45
125.67
124.91
123.71
117.87
109.80
77.49 CDCl3
77.07 CDCl3
76.64 CDCl3
34.37
31.48
28.69
26.79
22.53
14.07

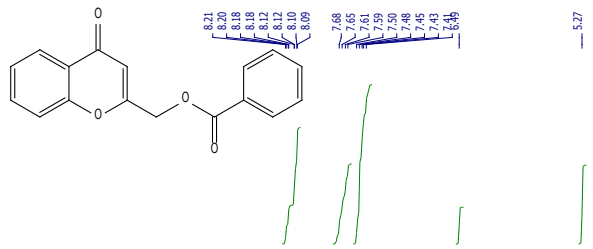

f1 (ppm)

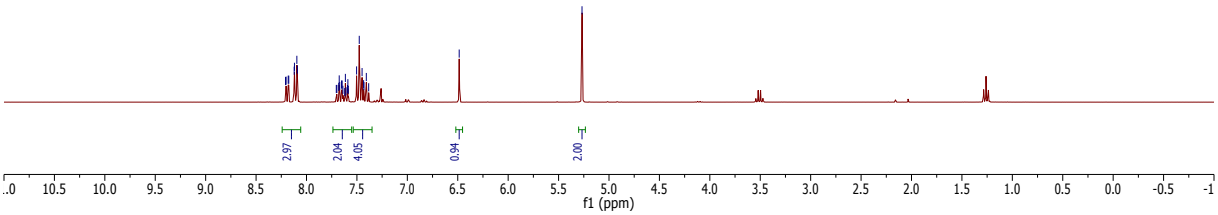

Abundance
Scan 3678 (22.181 min): zf-200-1.D\data.ms
160.1
121.1
230.2
92.1
65.1
187.1
212.2
141.1
253.0
281.0
307.1
331.0
355.0
405.2
428.9
m/z-->

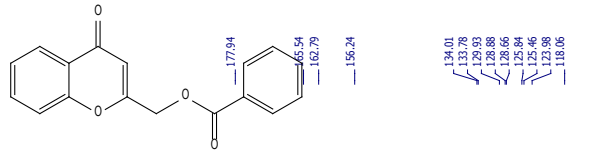

O
H3C
N
CH3
O
f1 (ppm)

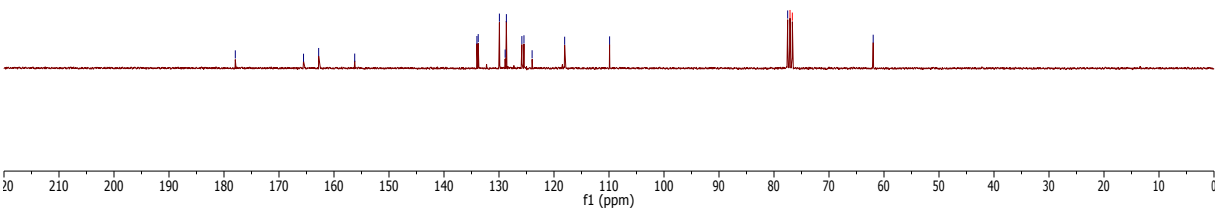

f1 (ppm)

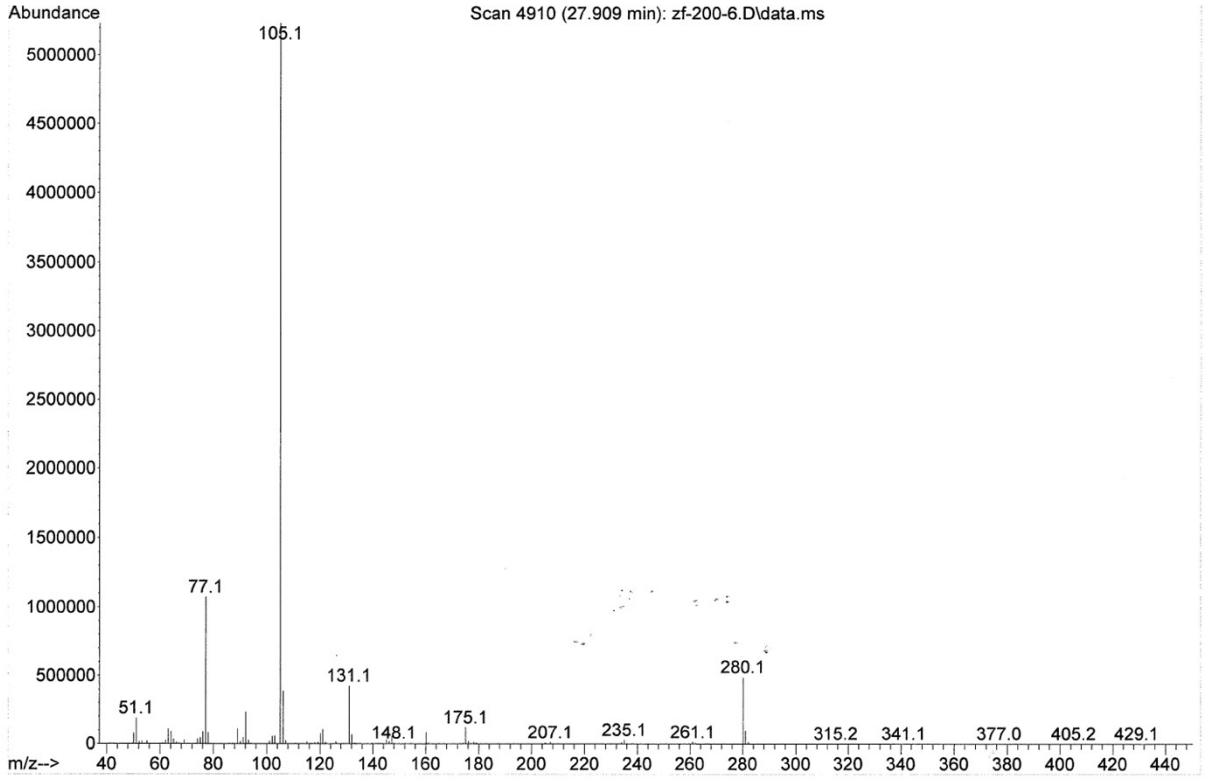

Abundance
Scan 3508 (21.391 min): zf-200-5.D\data.ms
216.2
131.1
96.1
160.1
77.1
56.1
115.1
182.0
198.1
232.2
252.9
281.3
341.1
403.2
m/z-->

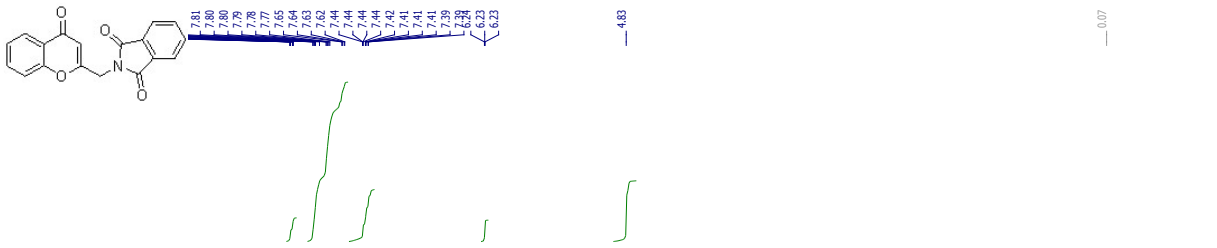

8.21
8.20
8.18
8.18
8.12
8.12
8.10
8.09
7.68
7.65
7.61
7.59
7.50
7.48
7.45
7.43
6.49
5.27

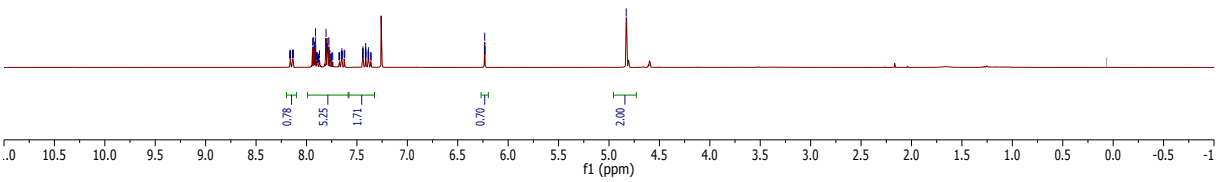

2.97
2.04
4.05
0.94
2.00
f1 (ppm)

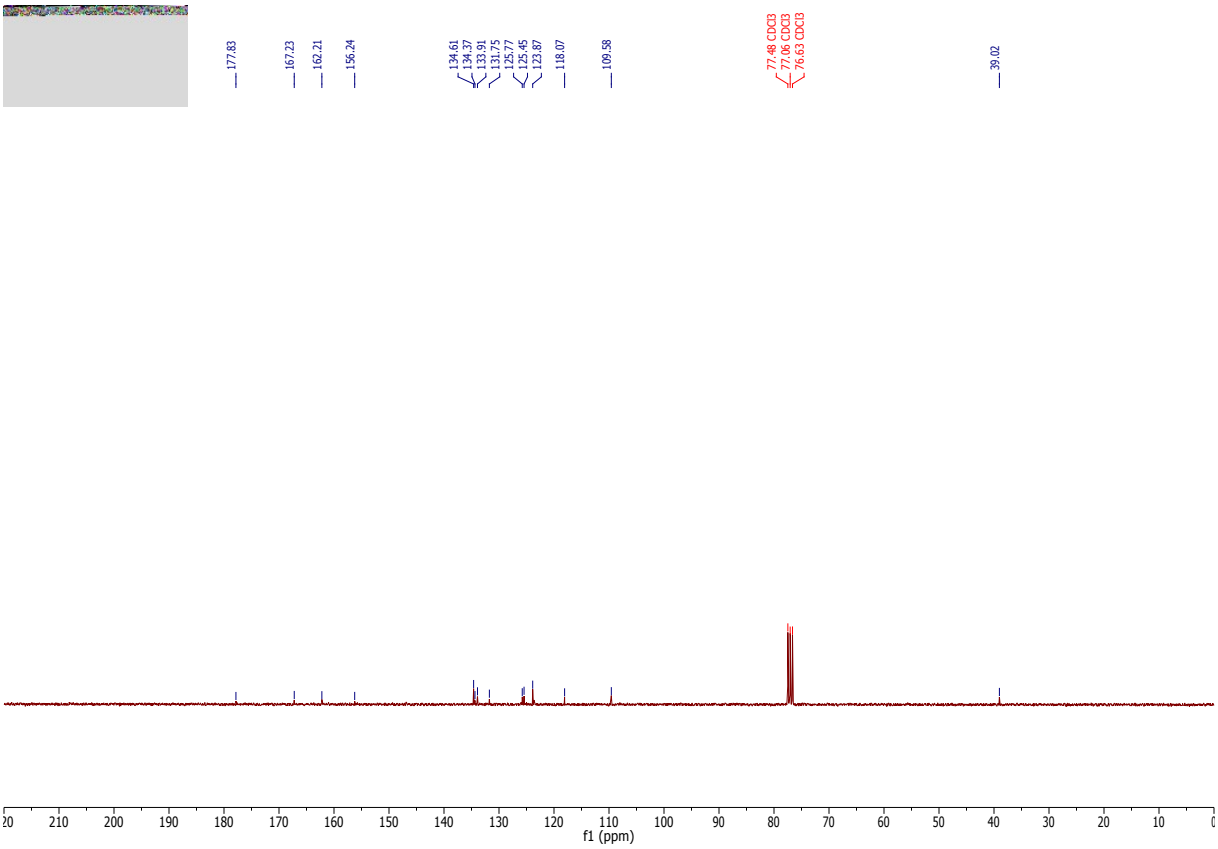

177.94
165.54
162.79
156.24
134.01
133.78
129.93
128.88
128.66
125.84
125.46
123.98
118.06
109.89
77.51
77.09 CDCl3
76.67 CDCl3
61.97

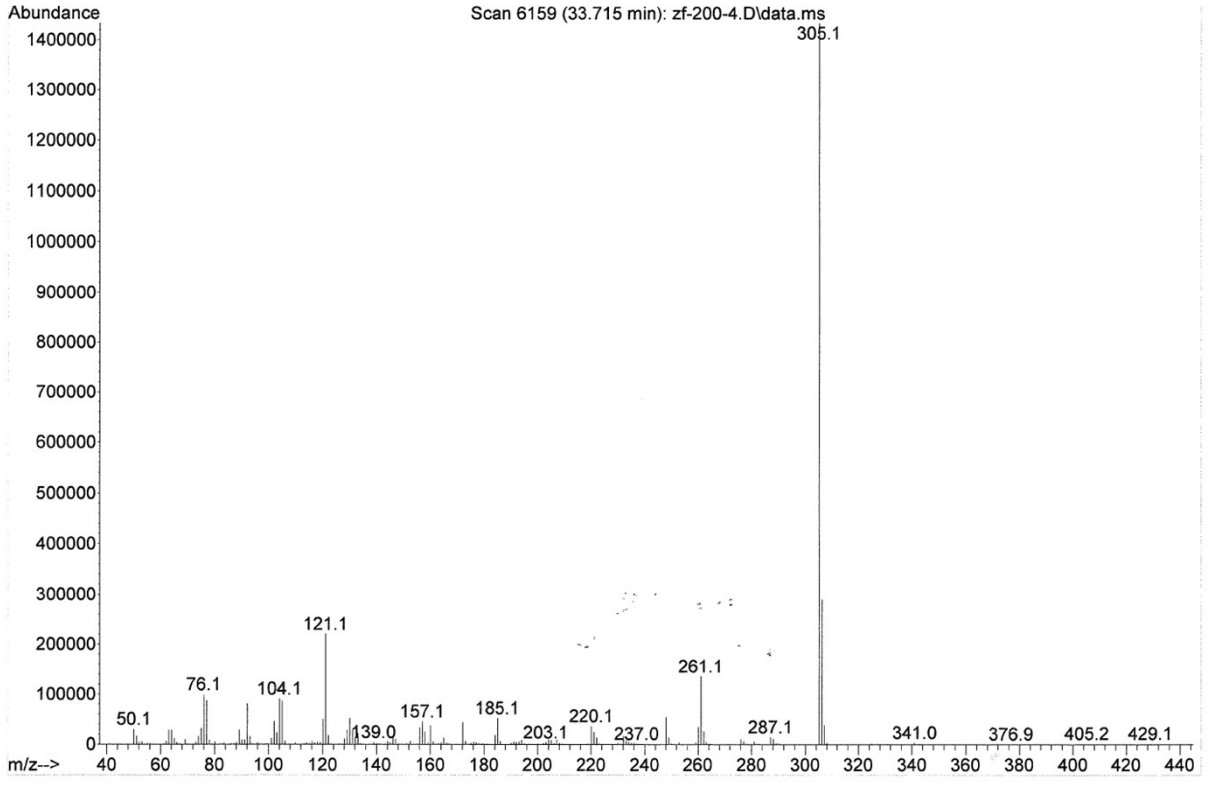

f1 (ppm)


Abundance
Scan 4910 (27.909 min): zf-200-6.D\data.ms
105.1
77.1
131.1
280.1
51.1
175.1
148.1
207.1
235.1
261.1
315.2
341.1
377.0
405.2
429.1
m/z-->




0.78
5.25
1.71
0.70
2.00
f1 (ppm)


177.83
167.23
162.21
156.24
134.61
134.37
133.91
131.75
125.77
125.45
123.87
118.07
109.58
77.48 CDCl3
77.06 CDCl3
76.63 CDCl3
39.02
f1 (ppm)


Abundance
Scan 6159 (33.715 min): zf-200-4.D\data.ms
305.1
121.1
261.1
76.1
104.1
50.1
157.1
185.1
139.0
203.1
220.1
237.0
287.1
341.0
376.9
405.2
429.1
m/z-->